September 2015

Link Light Rail Operations and Maintenance Satellite Facility

Final Environmental Impact Statement

TECHNICAL BACKGROUND INFORMATION

Appendix F

SoundTransit
Central Puget Sound
Regional Transit Authority

U.S. Department of Transportation
Federal Transit Administration

Appendix F.1

Additional Detail on the Two Site OMSF Option

LINK OPERATIONS AND MAINTENANCE SATELLITE FACILITY

Additional Detail on the Two Site OMSF Option

September 5, 2013

Rev 2

SOUND TRANSIT

CENTRAL PUGET SOUND
REGIONAL TRANSIT AUTHORITY

U.S. Department of Transportation
Federal Transit Administration

Table of Contents

List of Figures

List of Tables

Introduction

This paper evaluates in more detail the feasibility of constructing and operating two smaller Operating and Maintenance Satellite Facilities (OMSFs) to support the ST2 light rail fleet requirements. The paper is prepared in response to inquiries from partner jurisdictions requesting more information on why the Two Site OMSF Option was eliminated from further consideration during the environmental impact scoping process. The paper compares a Two Site OMSF Option to the alternatives being studied in the OMSF Draft Environmental Impact Statement (DEIS). The paper discusses Operation and Maintenance (O&M) facility functions, staffing requirements, estimated capital, operating and right-of-way (ROW) costs, and it assesses the consequences of a Two Site OMSF Option relative to future O&M facility requirements as the Link light rail system is expanded beyond ST2.

Background

Sound Transit's ST2 Plan includes light rail extensions from Seattle to Overlake in Redmond, Northgate to Lynnwood, and SeaTac to Kent/Des Moines. To implement the ST2 expansion, Sound Transit needs to increase its light rail vehicle fleet to approximately 180 vehicles by 2023. The existing light rail operations and maintenance facility (OMF) is located on a 25-acre site in the industrial area south of Downtown Seattle south of South Forest Street and west of Airport Way. It is sized and configured to serve 104 vehicles. Sound Transit must construct additional operations and maintenance facility capacity to support ST2's light rail vehicle storage and maintenance needs.

Sound Transit is evaluating alternatives to meet the needs of the expanded fleet of light rail vehicles required to serve the ST2 system. During the environmental scoping period for the OMSF, the idea of constructing two or more smaller O&M facilities in addition to the existing OMF was suggested as an alternative to constructing a single OMSF. An initial review of this concept revealed that it resulted in higher construction costs, duplicated functions and did not meet the project purpose to minimize system operating costs. More recently, interest in the Two Site OMSF Option has been raised by our partner jurisdictions, and they requested additional information. This paper provides a more detailed analysis of a Two Site OMSF Option.

Project Purpose

The project's purpose is to enable Sound Transit to meet the maintenance and storage needs of the expanded fleet of light rail vehicles identified in the ST2 Plan. ST2's vehicle acquisition and delivery schedule requires additional capacity to be operational by 2020. The OMSF project will:

- Accommodate expansion of the Link system to Lynnwood Transit Center, Overlake Transit Center and Kent / Des Moines;
- Support efficient and reliable light rail service and vehicle maintenance and minimize system annual operating costs; and
- Support regional long-range plans, including the Puget Sound Regional Council's (PSRC) VISION 2040 and Transportation 2040 plans, and Sound Transit's Regional Transit Long-Range Plan.

Identification of OMSF Sites

Potential OMSF sites identified for consideration in the DEIS were based on the following physical and operational requirements:

<u>Physical Requirements</u>

- **Location:** site is proximate to a built or funded light rail segment
- **Size:** accommodate at least 80 vehicles and include at least 20-25 acres of usable land
- **Configuration:** generally rectangular in shape

<u>Operational Requirements</u>

- **Operating Cost:** located within a transit corridor that minimizes the overall system operating costs
- **Reliability:** transition of light rail vehicles between the OMSF and the revenue line should not negatively impact revenue operations or the available nightly maintenance window (1:00 am to 5:00 am)
- **Efficiency:** site characteristics and location will minimize excessive vehicle maneuvering to position the trains for morning deployment

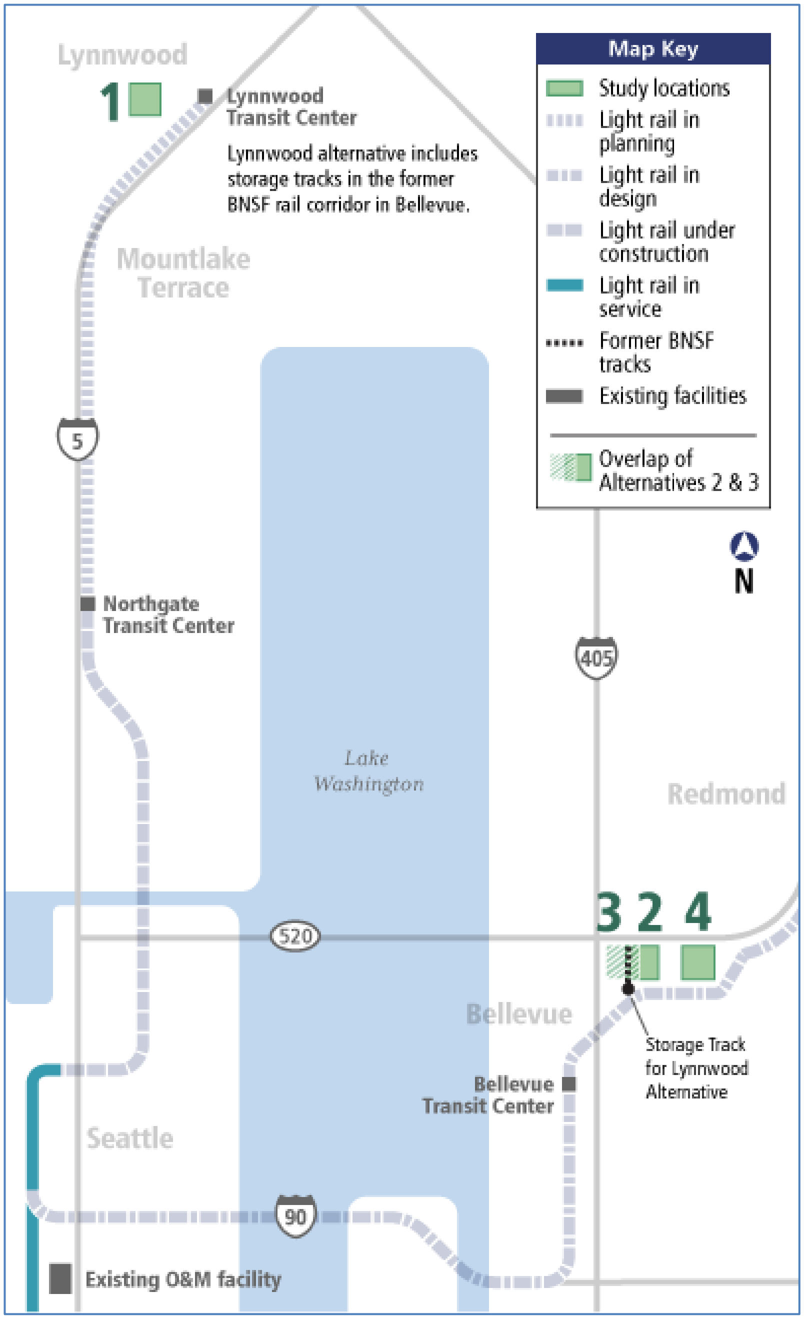
The sites that met the physical, operational and plan consistency requirements were included in environmental scoping process. At the December 20, 2012 Sound Transit Board meeting, four OMSF site alternatives were identified for study in the DEIS:

- Alternative 1: Lynnwood/BNSF Storage Tracks
  - Lynnwood C1
  - Lynnwood C2
  - Lynnwood C3
- Alternative 2: BNSF
- Alternative 3: BNSF Modified
- Alternative 4: SR520

Figure 1 shows the four OMSF site alternatives being studied in the DEIS. Alternative 1: Lynnwood/BNSF Storage Tracks site includes three different access options depending on which Lynnwood Link alignment is selected to service the Lynnwood Transit Center Station. It should be noted that Alternative 1: Lynnwood/ BNSF storage tracks; assumes 32 cars (or eight trains) will be stored on the BNSF tracks owned by ST in the Bel-Red area of Bellevue. This is required so morning service can start at the Overlake Transit Center at approximately 5:00 am.

The three Bellevue sites are also shown on Figure 1. Alternative 2: BNSF and Alternative 3: BNSF Modified is both located along the former BNSF rail corridor that is owned by Sound Transit and are in close proximity to the East Link 120th Station. Alternative 4: SR520 is located south of SR520 and north of NE 20th Ave.

Figure 1: OMSF Alternative Sites



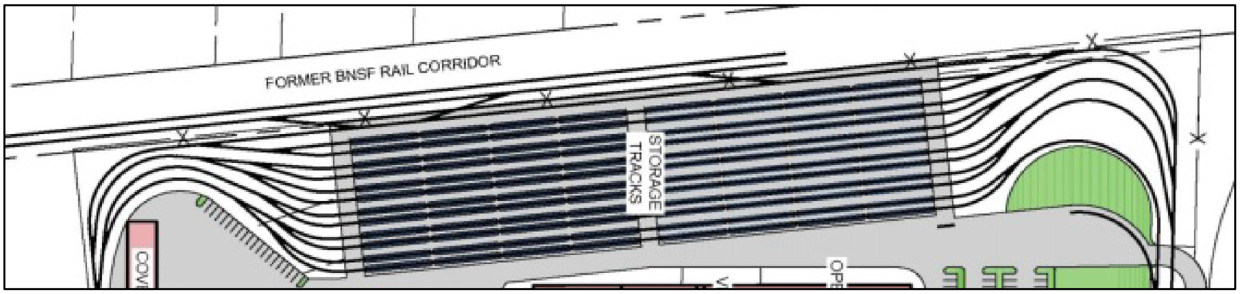
OMSF Storage Requirements

Sound Transit's current fleet is 62 light rail vehicles. The 62 vehicles are required to serve the extensions to the University of Washington and S. 200th Street planned to open in 2016. ST2 light rail expansion to Lynnwood and the eastside will require a fleet of approximately 180 light rail vehicles. The existing OMF has a storage capacity of 104 light rail vehicle (13 rows and 8 cars per row = 104). The future OMSF will need to accommodate a minimum of 76 vehicles (180 fleet – current 62 car fleet = 76 vehicles). However for planning purposes, a contingency of a 4-car train has been assumed. In addition, the Record of Decision (ROD) for East Link includes a future extension from the Overlake Transit Center to downtown Redmond. A condition of the East Link ROD is that before the line can be extended to downtown Redmond, maintenance facility capacity must be identified. It is estimated that 10 additional light rail vehicles will be required to provide service to downtown Redmond. Therefore, the need for a minimum of 90 storage spaces has been assumed for the future OMSF (76 vehicles + 4 spare spaces + 10 for Redmond = 90 storage spaces).

The dimensions and configuration of a typical light rail operations and maintenance facility is primarily driven by the space required for a runaround track. The runaround track allows vehicles to enter the site and either goes directly to the storage area or continues to the maintenance and/or wash bays for service and then return to the storage area directly without the operator changing ends of the train. The size is also driven by the size of the maintenance building and the number of storage tracks needed to accommodate the fleet. As stated previously, the existing OMF has 13 rows with eight cars per row. Assuming the OMSF will need to store and maintain 90 cars, a minimum of 11 rows of 8-cars is required. However, 11 rows of 8 cars each only allow space to store 88 cars. Adding a 12th row provides the opportunity to store up to 96 cars, and as a result, all OMSF sites assume storage for up to 96 cars (12 rows x 8 cars = 96). Figure 2 shows the typical storage space for 96 vehicles.

The ability to store 96 cars is also important for the future fleet and associated service requirement. See section “ST2 O&M Facility Needs verses Future Requirements” further in this report for more detail on future light rail feet needs.

Figure 2: OMSF Storage Tracks to Accommodate 96-Cars



Assumption of Two Site Storage Requirements

For the purpose of this paper it has been assumed that the two smaller OMSF site would accommodate storage for 48 light rail vehicles (96 cars/2 = 48 spaces). Storage for 48 cars requires 6 rows of parking with 8 cars per row. As a proof of concept, a layout for 48 cars has been developed for both the Lynnwood site and Alternative 2: BNSF. Figure 3 shows the Lynnwood alternative with the OMSF layout for 96 cars and a 48 car 19.1 acre site.

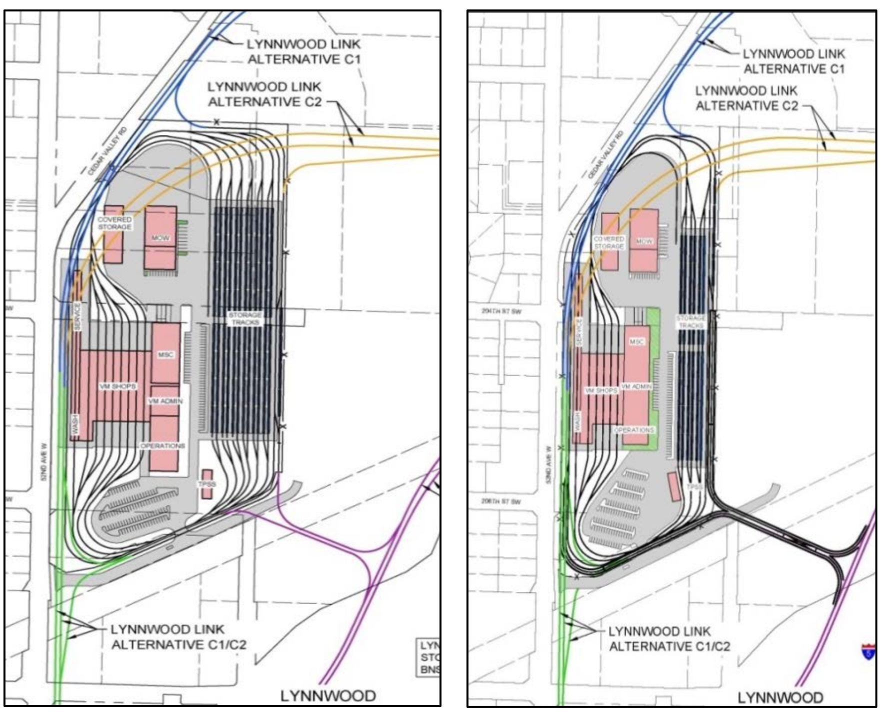
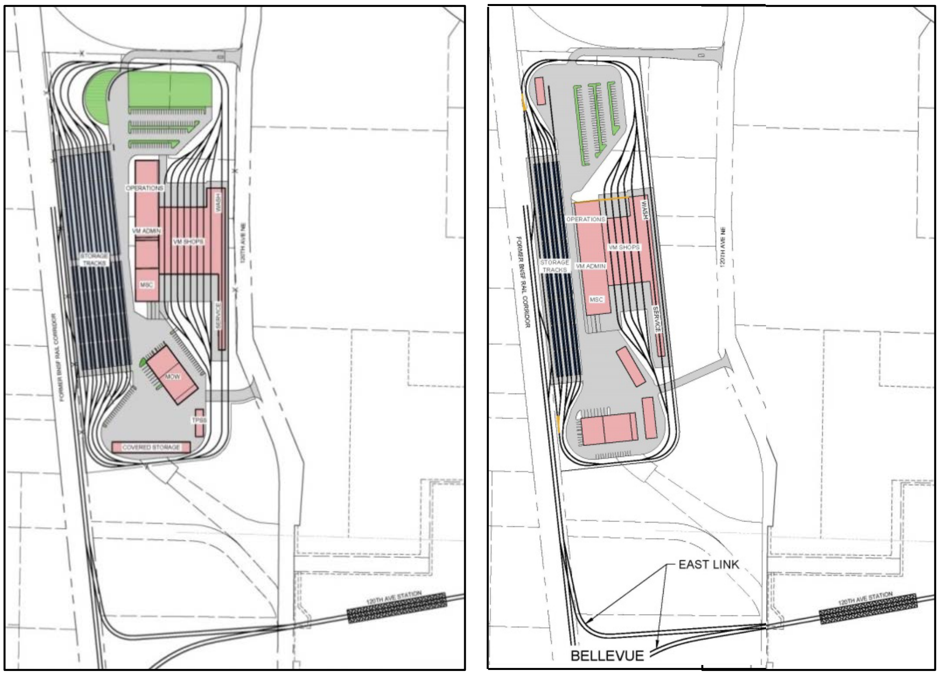


Figure 3: Lynnwood OMSF

Figure 4 shows both the 96 car and 48 car (16.6 acres) layouts for Alternative 2: BNSF in Bellevue. Both the 96-car and 48-car site concepts have similar boundaries to the north, south and west.

Figure 4: Bellevue BNSF Site



OMSF Functions

Table 1 compares site functions included in the existing Forest Street OMF, a 96-car OMSF, and the Two Site OMSF Option. The site functions are exterior, general, vehicle shop, maintenance functions, vehicle maintenance shop and the maintenance of way building (MOW).

Table 1: Site and Functions for the OMSF and Two-Site Option

Function	Forest Street OMF	96-Car OMSF	Two Site OMSF (each will include)
Exterior Areas			
Acres	24.8	22.5	16.6 and 19.1
LRV storage capacity	104	96	48
Non-Revenue Vehicle Parking	15	10	6
Employee/Visitor parking	150	110	90
Storage and laydown areas	✓	✓	✓
General			
Control Center	✓		
Training Area	✓	✓	✓
Dispatch	✓	✓	✓
Admin offices for operations & maintenance Staff	✓	✓	✓

Function	Forest Street OMF	96-Car OMSF	Two Site OMSF (each will include)
Maintenance Functions			
Loading Dock	✓	✓	✓
Battery Service Area	✓	✓	✓
Training Area	✓	✓	✓
Bulk Fluid Storage	✓	✓	✓
Compressor	✓	✓	✓
Waste/Hazardous Storage	✓	✓	✓
Emergency Generator	✓	Portable	Portable
Frame straightening capability	✓		
Paint shop	✓		
Major component replacement	✓		
Expanded parts storage	✓		
Space for vehicle overhauls	✓		
Vehicle Maintenance Shop			
Drive Thru Service Repair Bays	8	7	4 each
Car Washing	✓	✓	✓
Sanding (Sand Silo)	✓	✓	✓
Service & Inspection Bay	✓	✓	✓
In Floor Hoist	✓	✓	✓
Truck Shop	✓	✓	One base only
Overhead Cranes	✓	✓	✓
Parts Storage	✓	✓	✓
Wheel Truing	✓	✓	One base only
Maintenance of Way Building			
	✓	✓	✓
Test Area	✓	✓	✓
Welding Shop	✓	✓	✓
Equipment Storage			

The Forest Street OMF provides all the functions listed Table 1, including heavy maintenance functions such as frame straightening, a paint shop and the capability to overhaul vehicles. The Forest Street OMF includes the ability to store and maintain 104 light rail vehicles and all the functions of an OMF. In contrast the OMSF assumes maintenance and storage for up to 96 light rail vehicles on site (assumes build-out of all track storage area). It does not include the heavy maintenance functions or the capability to overhaul vehicles. The two smaller sites would have fewer service bays, only one of the sites would include wheel truing, and neither would have heavy maintenance functions.

Staffing Requirements

A complete list of staff by alternative and work assignment is shown in Table 2. The 96-car OMSF will require 231 employees. The total number of train operators does not increase with two smaller facilities; however additional operations and maintenance staff are required. Using this information the number of staff required to operate and maintain one OMSF verses two smaller facilities is summarized in Table 2. Because many of the staff functions are duplicated, two smaller sites require over 40 more staff, which increases operating costs when compared to a single OMSF.

Table 2: Summary Staff Positions by Title and Alternative

Title	Base OMSF	Two Site Option North	Two Site Option East	Two Site Option Total
ST On-Site ST Administration Staff				
Transportation Manager	1	1	Floating	1
Maintenance Manager	1	Floating	1	1
Transportation Superintendent	2	1	1	2
Maintenance Superintendent	2	1	1	2
Senior Administrative Specialist	1	1	1	2
Subtotal	**7**	**4**	**4**	**8**
KCM Rail Operation Staff				
Operations Assistant Superintendent	1	1	1	2
Administrative Specialist	1	1	1	2
Operations Base Chief	1	1	1	2
Operations Chief	2	1	1	2
Technical Trainer	1	1	1	2
Safety Officer	2	1	1	2
Dispatch	4	4	4	8
Field Supervisor	12	7	7	14
Operator	74	37	37	74
Subtotal	**98**	**54**	**54**	**108**
KCM Vehicle Maintenance Staff				
Vehicle Maintenance Assistant Superintendent	1	1	1	2
Light Rail Vehicle Engineer/QC Inspection	1	1	1	2
Administrative Specialist	1	1	1	2
Vehicle Maintenance Chief	4	2	2	4
Vehicle Maintenance Technical Trainer	1	1	1	2
Electro-Mechanic	47	24	24	48
Subtotal	**55**	**30**	**30**	**60**
KCM Vehicle Maintenance Staff				
LRV Service and Cleaning Chief	1	1	1	2
Rail Service Worker (cleaner)	25	12	12	24
Subtotal	**26**	**13**	**13**	**26**
MSC/Material Handling Staffing				
Maintenance Service Center Chief	1	1	1	2
Maintenance Service Center Worker	3	2	2	4
Subtotal	**4**	**3**	**3**	**6**
Facilities, WPS Staffing				
Facilities WPS Assistant Superintendent	1	1	1	2
Administrative Specialist	1	1	1	2
Track and ROW Chief	1	1	1	2
Track and ROW Maintainer	6	4	4	8
Grounds Specialist	2	1	1	2
Station Custodian	6	5	5	10
Laborer	1	1	1	2
Facilities Chief	1	1	1	2
Facilities Mechanic	3	3	3	6
Facilities Electrician	2	2	2	4
Facilities Custodian	3	2	2	4
Power Chief	1	1	1	2
Electrical Worker	8	4	4	8
SCAD System specialist	1	1	1	2
SCAD Technician	2	2	2	4
Signal/SCAD Chief	1	1	1	2
Subtotal	**40**	**31**	**31**	**62**
Total Employees	**230**	**135**	**135**	**270**
Net Increase in Staff by Alternative	**-**			**40**

Table 3 shows the approximate square footage required to accommodate the OMSF program and a Two Site OMSF Option. Many of the site requirements for two separate facilities are duplicative, and as a result the two smaller facilities would add an overall total of approximately 11 additional acres of space. The increased space requirements increase construction costs substantially.

Table 3: Staff and Square Footage per Site

			Two Site OMSF Option					
	OMSF Program		North		East		Total	
Area Description	Staff	Area (sq. ft.)	Staff	Area (sq. ft.)	Staff	Area (sq. ft.)	Staff	Area (sq. ft.)
Operations/Maintenance Building Area								
Sound Transit Administration	7	1,058	4	741	4	741	8	1,481
Rail Ops: Administration	8	7,247	6	6,522	6	6,522	12	13,045
Rail Ops: Dispatch & Support	90	8,556	49	4,278	49	4,278	90	8,556
VM: Administration	8	7,052	6	7,052	6	7,052	12	14,104
VM:LRV Repair Positions & Shops	47	56,070	24	39,249	24	39,249	48	78,498
VM: Shop Storage/Support	0	4,805	0	3,364	0	3,364	0	6,727
LRV Service Areas	26	18,007	13	12,605	13	12,605	26	25,210
MSC/Material Handling	4	18,311	3	18,311	3	18,311	6	36,622
Subtotal	**190**	**121,106**	**105**	**92,121**	**101**	**92,121**	**202**	**184,243**
Facilities/WPS Building Areas								
Facilities/WPS: Office	40	5,659	31	4,527	31	4,527	62	9,054
Facilities WPS: Shop & Support Areas	0	14,760	0	10,332	0	10,332	0	20,664
Subtotal	**40**	**20,419**	**31**	**14,859**	**38**	**14,859**	**62**	**29,718**
Total All Buildings	**230**	**141,525**	**132**	**106,981**	**139**	**106,981**	**271**	**213,961**
Total All Exterior Areas		**348,031**		**257,980**		**257,980**		**515,959**
Total Building and Exterior Areas		**489,556**		**364,960**		**364,960**		**729,920**
Site Circulation/Landscape/Setbacks		**489,556**		**364,960**		**364,960**		**729,920**
Total Site Requirements		**979,112**		**729,920**		**729,920**		**1,459,840**
Acres		**22.5**		**16.8**		**16.8**		**33.5**

Estimated Project Costs

The estimated project costs are reported in three categories; capital, operating and ROW. As indicated above the capital and operating costs associated with the Two Site OMSF Option are greater than building one OMSF. These cost differences will be even more pronounced in the future when additional operations and maintenance facility capacity will be needed to serve the light rail system beyond the ST2 expansion.

Estimated Capital Costs

The capital costs for a single OMSF versus two O&M facility sites are shown in Table 3. The range of capital costs vary by OMSF alternative being evaluated in the Draft EIS. The range is $200 million (Alt. 2: BNSF) to

$243 million (Alt 1: Lynnwood). The difference in the two options is between $69 million and $112 million depending upon the alternative.

Table 4: Estimated Capital Costs (millions of 2013$)

Two Site OMSF Option	OMSF*	Difference
$312	$200 to $243	$69 to $112

*Assumes range of costs associate with EIS alternatives

Operating Costs

The estimated operating costs are primarily driven by staffing requirements. As shown in Table 2, the Two Site OMSF Option requires over 40 additional employees. The need for additional staff results in an estimated annual operating cost that is $5 million greater than a single OMSF (see Table 5).

Table 5: Annual Operating Costs (millions of 2013$)

Two Site OMSF Option	OMSF	Difference
$68	$63	$5

Estimated Right-of-Way Costs

In addition to capital and operating costs, the construction of two smaller facilities would not necessarily reduce the ROW costs for each site. Figures 3 and 4 show the “proof of concept” layouts for a 48-car site compared to the 96-car sites for Lynnwood (Alt. 1) and the BNSF (Alt. 2). In the case of the BNSF site, the total number of parcels needed to build the 48-car option verses the OMSF 96-car option are roughly the same, with the exception of the parcel in the northeast corner of the site. The same is true of the Lynnwood site, where the smaller 48-car option requires the same number of parcels to be purchased. Therefore, the construction of two 48-car facilities would result in no savings in the initial ROW costs over the 96-car facility.

ST2 O&M Facility Needs versus Future Requirements

The Two Site OMSF Option must be considered in the context and needs associated with the eventual expansion of the light rail system as envisioned in the Sound Transit adopted Long-Range Plan and the PSRC’s Vision *2040* and Transportation *2040* regional plans. This expansion assumes extending light rail to Everett in the north, Tacoma in the south and Downtown Redmond in the east.

Light Rail System Expansion

The needs associated with the future light rail expansion are documented in the *Task 2.3B Technical Memo; Core Light Rail System Expansion* (available on the OMSF project ST website). The memo identified the following future light rail system and its features:

- Future ridership demand will require trains to operate every three minutes in the peak periods through the 8.7 mile tunnel that extends from the International District/Chinatown Station to just south of the Northgate Station and every six minutes in the off-peak;
- Four-car trains will need to be operated in the peak periods; and
- A fleet of up to approximately 300 light rail vehicles will be required to meet the ridership demand.

To meet this future operations plan, three O&M facilities will be required. These sites include the existing Forest Street OMF heavy maintenance facility, a second O&M heavy maintenance facility plus one satellite O&M facility. The system operations and passenger demand require that one of the new O&M facilities be located along the north operating line to Everett and one along the east operating line to Downtown Redmond. Based on this requirement, no matter which corridor is selected for an OMSF to meet the ST2 fleet needs, a second Operations and Maintenance Facility will eventually be needed in the other corridor.

Impact of Selecting the Two Site OMSF Option to Serve ST2

Selecting the Two Site OMSF Option for ST2 would have implications for accommodating the fleet associated with a future light rail expansion. Four possible scenarios have been identified to serve the future light rail fleet needs. The assumptions that define the four scenarios are described below and the advantages and disadvantages of each scenario are discussed in Table 6.

Scenario A: Build one OMSF Now and One in the Future

- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct one 96-car OMSF to serve the ST2 fleet, either in the north or east
- In addition to the Forest ST OMF and ST2 OMSF, add a third ~100-car O&M facility in the future in either the north or east corridors, whichever corridor is not selected for the ST2 facility.

Scenario B: Build Two 48-Car O&M Facilities for ST2 and Expand Both in the Future

- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct a 48-car OMSF in the north corridor to serve the ST2 fleet and expand the facility to a ~100-car O&M facility in the future
- Construct a 48-car OMSF in the east corridor to serve the ST2 fleet and expand the facility to a ~100-car O&M facility in the future

Scenario C: Build Two 48-Car O&M Facilities for ST2, Demolish and Build two Full-size O&M Facilities in the Future

- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct a 48-car OMSF in both the north and east corridors to serve the ST2 fleet

- Decommission/demolish the 48-car OMSF's in the north and east corridors and construct two new ~100-car O&M facilities in each corridor

Scenario D: Build Two 48-Car O&M Facilities for ST2, Add Two 48-car O&M Facilities in the Future

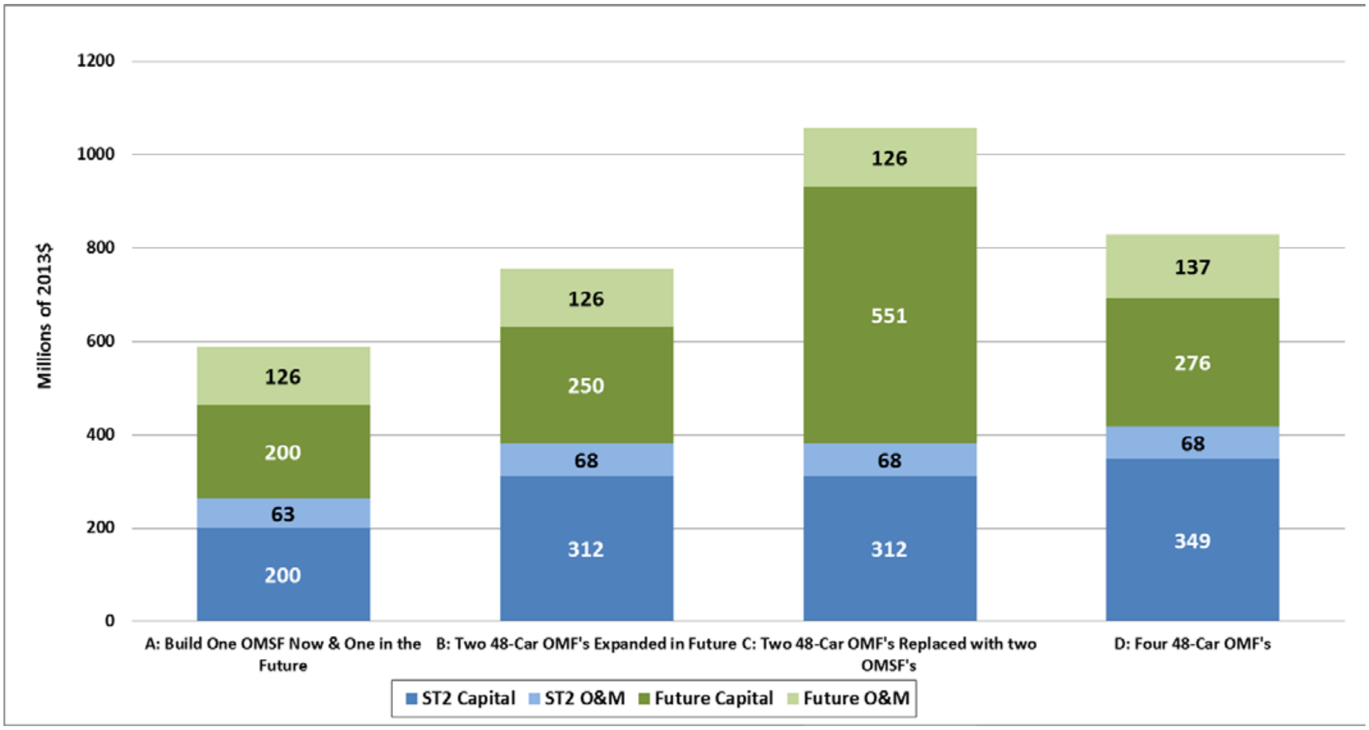
- Continued use of the Forest Street OMF as a heavy maintenance facility
- Construct a 48-car facility in both north and east now
- In the future construct additional 48-car facilities in both the north and east (one of the facilities will need to accommodate heavy maintenance functions)

Table 6: Advantages and Disadvantages of each Scenario

Scenario	Advantages	Disadvantages
A: Build One OMSF Now and one in the future	• Lowest cost scenario • Defers decision of siting the second facility (in addition to the Forest Street OMF) • Expands the potential locations for a second facility in the future	• Risk of future land availability • ROW costs could be higher in the future
B: Build Two 48-Car O&M Facilities for ST2 and Expand Both in the Future	• Potentially lower cost than scenarios C and D	• Requires the purchase of the land for the future expansion of the site now or this scenario is not feasible • Future expansion would disrupt existing service, maintenance and deployment, and may be a fatal flaw
C: Build Two 48-Car O&M Facilities for ST2, Decommission and Build two Full-size O&M Facilities in the Future	• Defers decision of siting a second facility	• Highest total cost • Risk of future land availability • Highest overall ROW cost • Requires ST to reimburse FTA for the remaining useful life of the facilities • Not consistent with ST's asset management guidelines. Would add additional equipment replacement needs over a single site
D: Build Two 48-Car O&M Facilities for ST2, Add Two 48-car O&M Facilities in the Future	• Defers decision of siting a second facility	• Risk of future land availability • Increased ROW costs • Increase operating costs • Not consistent with ST's asset management guidelines. Would add additional equipment replacement needs over a single site

Figure 5, illustrates the estimated capital (excludes right-of-way) and operating costs associated with the four scenarios in constant 2013 dollars. Scenario A is the lowest cost option and assumes a second full-size OMSF to support the future fleet expansion would be constructed in the corridor not selected to support ST2 fleet expansion. Scenario C is the highest cost, and assumes that the two 48-car O&M facilities built to service ST2 would be demolished and replaced with two full-size OMSF's, one in the north corridor and one in the East Corridor. It is likely that one of the two new OMSF's would be built north of Lynnwood on the way to Everett, and the east base built in Redmond assuming potential sites in the Bel-Red area have been developed.

Figure 5: Two Site OMSF Scenarios Estimated Capital and Operating Costs (2013 constant $)



Note: Capital Costs for 96-car facility is based on Alternative 2: BNSF

Findings

The findings of the Two Site OMSF Option are summarized below:

1. Two smaller facilities to accommodate the ST2 fleet would require more land in total than the individual site alternatives being studied in the EIS (approximately 36 acres total compared to 22 to 25 acres). This option would have associated increases in property acquisition costs.

2. Two smaller O&M facilities would require more staff than one 96-car OMSF. It is estimated that two smaller facilities would result in approximately 40 additional operations and maintenance staff to run the facilities. The result is an increase in annual operating costs of over $5 million.

3. Sound Transit is developing asset management guidelines to address the life-cycle replacement costs of its ever growing number of assets. An O&M facility consists of many elements and large numbers of specialized equipment. The construction of two smaller facilities to meet the ST2 fleet requirements would result in an additional facility to maintain and the need to replace greater number of redundant specialized equipment. Some of the asset management costs are reflected in the $5 million additional annual operating cost difference between building a single OMSF versus two smaller facilities.

4. The capital costs for a single 96-car OMSF is estimated at between $200 and $243 million. The cost of two 48-car facilities is estimated at $312.4 million, or $69 million to $112 million more than the 96-car facility.

5. Scenario A (Build One OMSF Now and One in the Future) advantages are that it has the lowest cost, defers decision of where to site the second facility and expands the potential search area for locating a second facility. The disadvantages include the risk of future land availability and potentially higher ROW costs in the future.

6. Scenario B (Build Two 48-Car O&M Facilities for ST2 and Expand Both in the Future) has the advantage of potentially lower construction costs than scenarios C and D, but is still more expensive than Scenario A. The disadvantages include the need to purchase land for the future expansion now to assure the land is available when both sites are expanded. In addition, expanding a facility that is currently in operation would likely disrupt existing maintenance functions and the deployment of trains. Ultimately, this scenario would conflict with partner agencies' desire for a smaller facility, which is the genesis of this evaluation.

7. Scenario C (Build Two 48-Car O&M Facilities for ST2, Demolish and Build two Full-size O&M Facilities) has the advantage of deferring the decision of where to locate a second facility. The disadvantages include that it has the highest total cost, there is risk of future land availability, it has the highest ROW cost, would require ST to reimburse FTA for the remaining useful life of the facilities and is not consistent with ST's asset management guidelines.

8. Scenario D (Build Two 48-Car O&M Facilities for ST2, Add Two 48-car O&M Facilities in the Future) has the advantage of deferring the decision of where to locate the two new facilities. The disadvantage includes the risk of future land availability and risk of finding two alternative sites in the future and on-going higher operating costs.

Conclusion

The analysis and findings discussed in this paper confirms the assessment made during the EIS scoping process that the Two Site OMSF Option should not be analyzed further. The Two Site OMSF Option will be discussed in Chapter 2 of the DEIS as an alternative considered but not carried forward.

Attachment 1
Two Site OMSF Option Assumptions for Comparison

The Two Site OMSF option design and cost estimates have been developed using the Alternative 2 (BNSF) as the basis of design. Site elements, buildings, and track work have been adjusted for each alternative to meet the needs of a 48 car program.

- Track Cost Ratio: This cost is based on the linear feet of track of the 48-car and 96-car options (48-cars 15,165 LF / 96-cars 26,144 LF = 0.58 linear feet of track

- The Main Building:
    - The 96-car shop has 7 shop tracks through the building. The 48-car shop has 4 shop tracks
    - Using a ratio of 4 tracks/7 tracks=0.57, then rounding to 60%. Although the total number of cars is reduced by 50% there will be some components and space that cannot be cut in half
    - Circulation within the shop areas is not reduced by 50%
    - The Service/Clean and Wash are not reduced

- MOW Building: The Maintenance-of-Way (MOW) functions are unlikely to be reduced significantly. No reduction is taken

- Auxiliary Building is similar to the MOW Building and is not reduced

- Maintenance equipment is reduced for some items to a single unit where appropriate. Miscellaneous shop equipment is reduced by the 4 tracks/7 tracks ratio.

- Site Work General:
    - Within the detail for the track work, Embedded Track is adjusted based on the 4/7 ratio, rounded to 60%
    - Traffic Signals and Crossing are not adjusted as these are at the access points to the site
    - All other track work items are adjusted by the Track Ratio of 58%

- Site Work Utilities: These are adjusted based on the Site Size ratios, however, for public utilities, an additional 5% was added for taps and miscellaneous baseline cost.
    - Water Supply was adjusted by the Site Size Ratio + 5%
    - Sanitary was adjusted by the Site Size Ratio + 5%
    - Stormwater was adjusted by the Site Size Ratio
    - Gas Supply was adjusted by the Site Size Ratio + 5%
    - Site Electrical includes the relocation and connection to existing power distribution. This work was not adjusted; the remainder of the Electrical Supply and Distribution was adjusted by the Site Size Ratio + 5%
    - Site Lighting was adjusted by the Site Size Ratio
    - Site Communication and Security was adjusted by the Site Size Ratio

- Site Work Connecting Lead Track: not adjusted

Appendix F.2

Land Acquisition Data

Appendix F.2
Land Acquisition Data

The Sound Transit Link Light Rail Operations and Maintenance Satellite Facility (OMSF) project (proposed project) would require acquiring property and presumes displacing and relocating some existing uses. This appendix presents the likely property acquisitions based on the current conceptual designs of the OMSF. This list of acquisitions could be updated as the project design is refined; therefore, it should not be interpreted as the final determination regarding property acquisition. Furthermore, the estimates described in this appendix reflect existing conditions at the time the analysis was conducted. Accordingly, the number and/or type of displacements could vary between what has been disclosed in this Final Environmental Impact Statement (Final EIS) and what is actually required because currently underdeveloped or vacant properties might be developed between the publication date of this Final EIS and the time of construction.

There are two types of property acquisitions: partial and full.

- **Partial acquisitions.** Partial acquisitions acquire part of a parcel and generally do not displace the existing use. In a few instances, some of the businesses on a parcel are displaced.
- **Full acquisitions.** Full acquisitions acquire the full parcel and displace the current use. Full acquisitions include parcels that might not be fully needed for the project but are affected to the extent that existing uses are substantially impaired (e.g., loss of parking or access). This includes parcels that are acquired for construction activities, although, in some cases, all or part of the parcels would be available for other use or redevelopment after construction is complete.

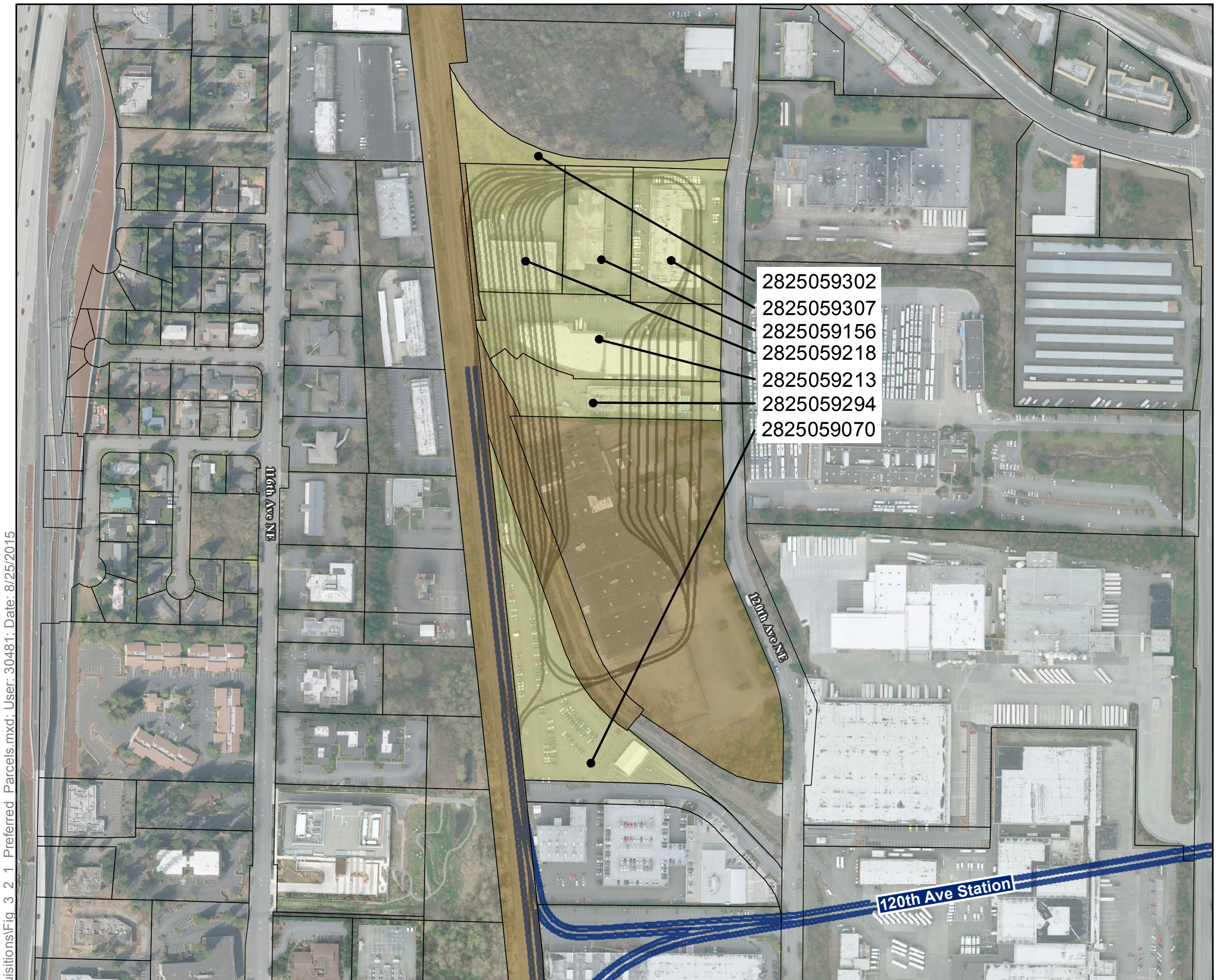
Tables F.2-1 through F.2-5 AND Figures F.2-1 through F.2-4b in this appendix present information on the likely acquisitions by build alternative for the proposed project. Information associated with partial and full acquisitions for each build alternative was collected from aerial photos, King and Snohomish County geographic information system (GIS) data, and windshield reconnaissance site visits.

In addition to the potential property acquisitions described, the proposed project could also require subterranean easements, temporary construction easements, and the use of public rights-of-way not listed here.

Table F.2-1. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—Preferred Alternative (BNSF)

Parcel Number	Existing Land Use
282505-9302	1 – Vacant
282505-9156	1 – Commercial/Retail Service 2 – Industrial
282505-9218	1 – Commercial/Retail Service 1 – Commercial Office 1 – Industrial
282505-9213	3 – Commercial Office 2 – Industrial
282505-9294	1 – Industrial
282505-9298	1 – Vacant (right-of-way owned by Sound Transit)
282505-9307	1 – Commercial Office
282505-9326	1 – Vacant (right-of-way owned by Sound Transit)
282505-9070	1 – Commercial Retail/Services
282505-9182	1 – Vacant (owned by Sound Transit)
Total Displacements by Land Use	3 – Commercial Retail/Service 5 – Commercial Office 6 – Industrial 3 – Vacant (owned by Sound Transit) 1 – Vacant

The Preferred Alternative (BNSF) site includes the International Paper facility, along with various commercial/light industrial uses, such as Eastside Staple and Nail, a medical supply facility, some technology based businesses, and a part of the Audi car dealership.



Parcel Number	2825059302
Land Use	Vacant
Parcel Size	1.20 AC

Parcel Number	2825059307
Land Use	Commercial - Office
Parcel Size	2.20 AC

Parcel Number	2825059156
Land Use	Commercial - Retail/Service, & Industrial
Parcel Size	1.55 AC

Parcel Number	2825059218
Land Use	Commercial - Retail/Service, Commercial - Office, & Industrial
Parcel Size	2.10 AC

Parcel Number	2825059213
Land Use	Commercial - Office & Industrial
Parcel Size	3.22 AC

Parcel Number	2825059294
Land Use	Industrial
Parcel Size	1.67 AC

Parcel Number	2825059070
Land Use	Commercial- Retail/Service
Parcel Size	3.42 AC

Affected Parcel
Sound Transit Owned
Parcel
Site Plan
East Link Extension

N
0 0.25 Miles
0 0.25 Kilometers

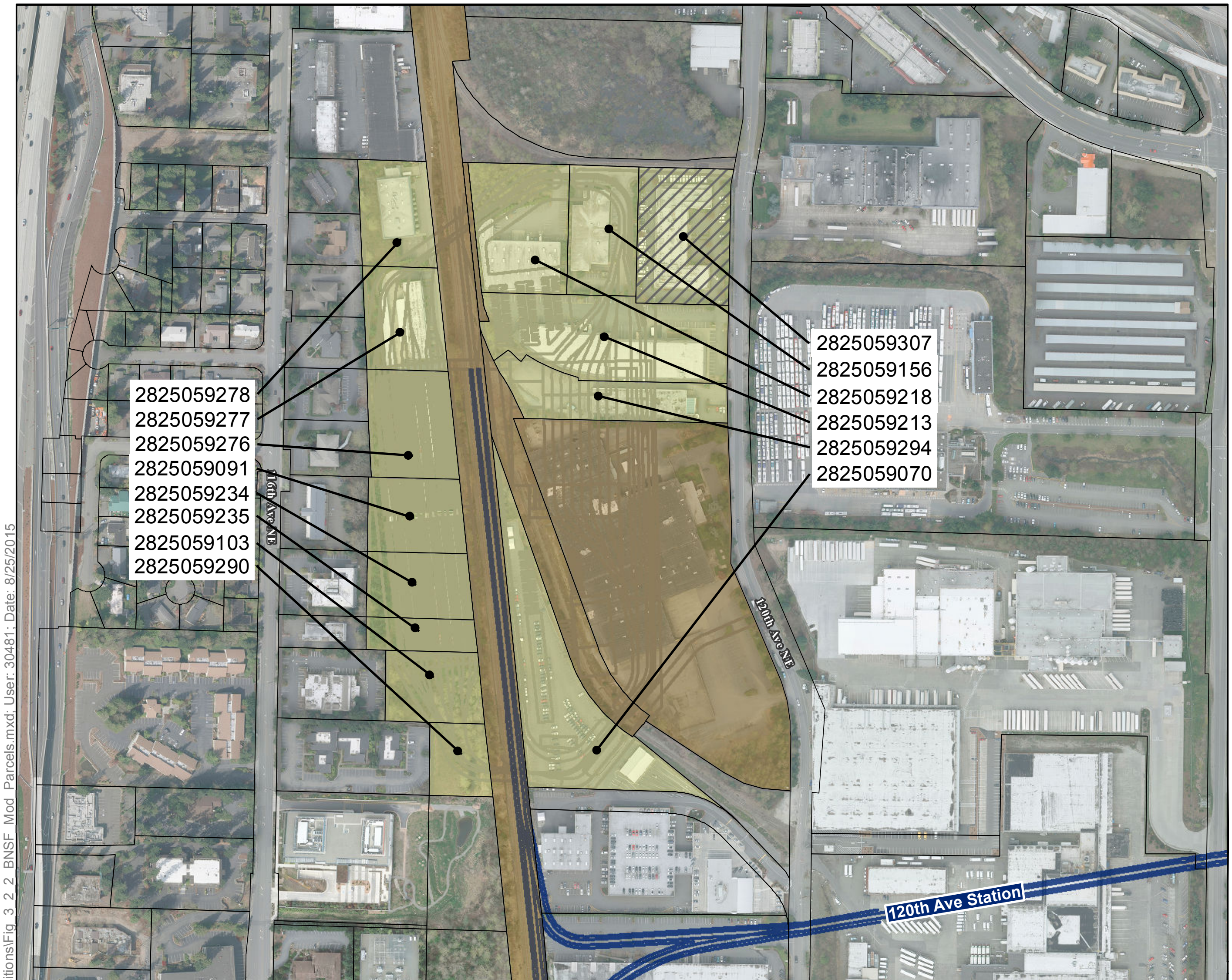
Source: Aerial Imagery and Parcels, City of Bellevue, 2013; Site plans, Huitt Zollars, 2015

Figure F.2-1: Preferred Alternative—Affected Parcels
Sound Transit Link Light Rail OMSF Final EIS

Table F.2-2. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—BNSF Modified Alternative

Parcel Number	Existing Land Use
282505-9278	1 – Commercial Retail/Service
282505-9277	1 – Commercial Retail/Service
282505-9276	8 – Commercial Office 1 – Industrial
282505-9091, 282505-9234, and 282505-9235	1 – Industrial
282505-9298	1 – Vacant (right-of-way owned by Sound Transit)
282505-9307	Partial – No Displacement
282505-9103 and 282505-9290	2 – Vacant
282505-9182	1 – Vacant (owned by Sound Transit)
282505-9156	1 – Commercial Retail/Service 2 – Industrial
282505-9218	1 – Commercial Retail/Service 1 – Commercial Office 1 – Industrial
282505-9213	4 – Commercial Office 1 – Industrial
282505-9294	1 – Industrial
282505-9326	1 – Vacant (right-of-way owned by Sound Transit)
282505-9070	1 – Commercial Retail/Service
Total Displacements by Land Use	5 – Commercial Retail/Service 13 – Commercial Office 3 – Vacant (owned by Sound Transit) 1 – Vacant

The BNSF Modified Alternative site includes many of the same parcels as the Preferred Alternative (BNSF); however, the BNSF Modified Alternative site extends across the Eastside Rail Corridor, incorporating 9 additional acres of industrial/commercial uses, and excludes a 1-acre parcel at the northernmost part of the BNSF Modified Alternative site, on the east side of the corridor. Three of the additional parcels are developed, providing land for the Bellevue Public Safety Training Center. The training facility is equipped with drill areas for firefighters and other public safety officers.



Parcel Number	2825059278
Land Use	Commerical- Retail/Service
Parcel Size	1.32 AC

Parcel Number	2825059277
Land Use	Commerical- Retail/Service
Parcel Size	1.40 AC

Parcel Number	2825059276
Land Use	Commercial - Office & Industrial
Parcel Size	1.58 AC

Parcel Number	2825059091
Land Use	Industrial
Parcel Size	1.22 AC

Parcel Number	2825059234
Land Use	Industrial
Parcel Size	1.17 AC

Parcel Number	2825059235
Land Use	Industrial
Parcel Size	0.62 AC

Parcel Number	2825059103
Land Use	Vacant
Parcel Size	1.17 AC

Parcel Number	2825059290
Land Use	Vacant
Parcel Size	0.76 AC

Parcel Number	2825059307
Land Use	Partial - No Displacement
Parcel Size	2.20 AC

Parcel Number	2825059156
Land Use	Commercial - Retail/Service, & Industrial
Parcel Size	1.55 AC

Parcel Number	2825059218
Land Use	Commercial - Retail/Service, Commercial - Office & Industrial
Parcel Size	2.10 AC

Parcel Number	2825059213
Land Use	Commercial - Office & Industrial
Parcel Size	3.22 AC

Parcel Number	2825059294
Land Use	Industrial
Parcel Size	1.67 AC

Parcel Number	2825059070
Land Use	Commercial- Retail/Service
Parcel Size	3.42 AC

Affected Parcel
Sound Transit Owned
Partially Affected Parcel
Parcel
Site Plan
East Link Extension

N
0 0.25 Miles
0 0.25 Kilometers

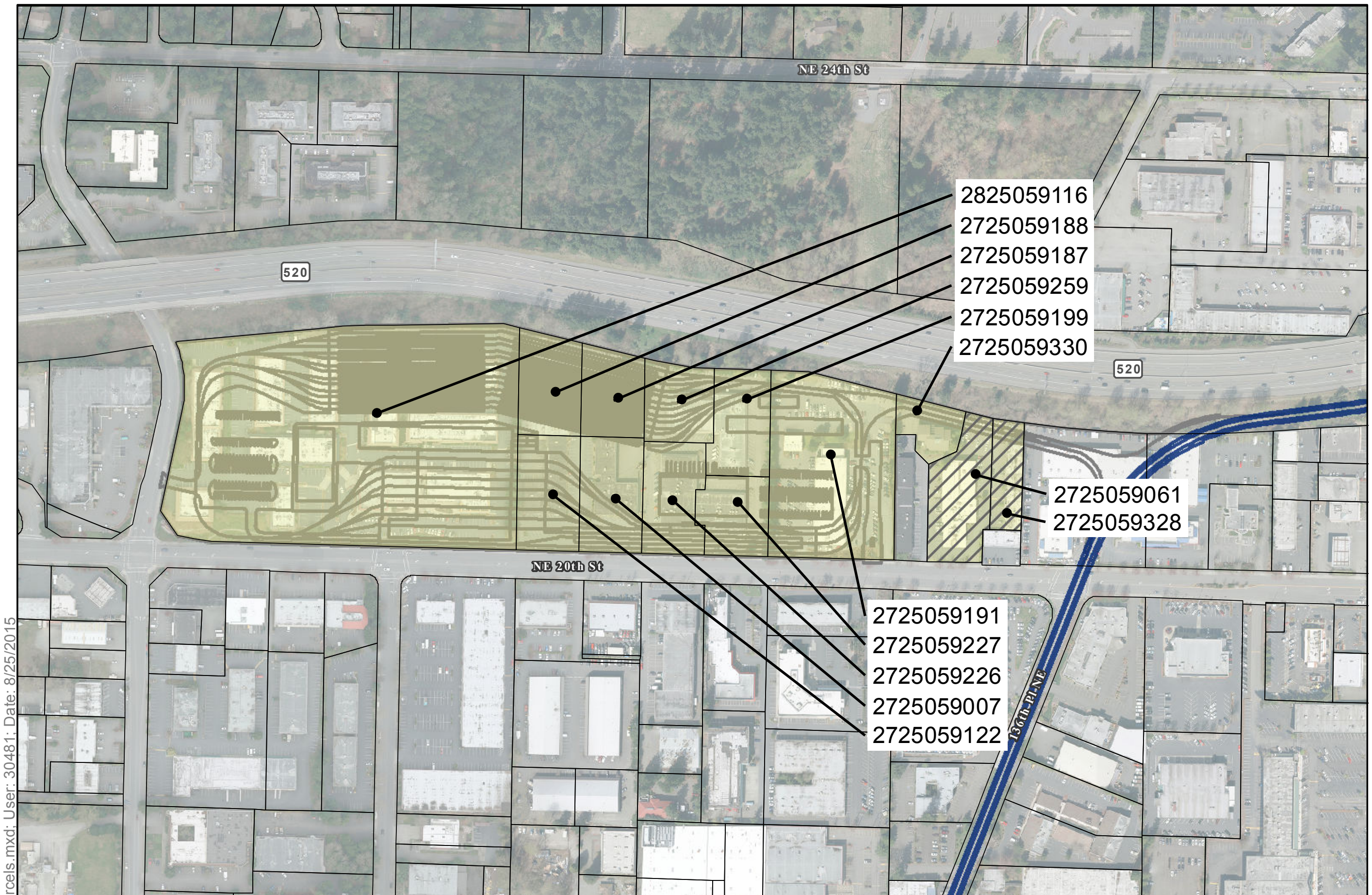
Source: Aerial Imagery and Parcels, City of Bellevue, 2013; Site plans, Huitt Zollars, 2013

Figure F.2-2: BNSF Modified Alternative—Affected Parcels
Sound Transit Link Light Rail OMSF Final EIS

Table F.2-3. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—SR 520 Alternative

Parcel Number	Existing Land Use
282505-9116	19 – Commercial Retail/Service 9 – Commercial Office
272505-9188	7 – Commercial Retail/Service 15 – Commercial Office
272505-9122, 272505-9259, 272505-9226, 272505-9199, and 272505-9227	13 – Commercial Retail/Service 5 – Commercial Office
272505-9187	13 – Commercial Retail/Service 8 – Commercial Office
272505-9007	5 – Commercial Retail/Service 5 – Commercial Office
272505-9191	1 – Commercial Retail/Service
272505-9330	1 – Commercial Office
272505-9061	Partial – No Displacements
272505-9328	Partial – No Displacements
272505-9148	Acquisition of this parcel included in East Link Project
Total Displacements by Land Use	58 – Commercial Retail/Service 43 – Commercial Office

The SR 520 Alternative site contains a broad range of commercial uses in mostly one-level, strip-style developments. Uses include a variety of retail and restaurants, with some offices.



Parcel Number	2825059116
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	11.60 AC

Parcel Number	2725059188
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	0.99 AC

Parcel Number	2725059187
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	0.85 AC

Parcel Number	2725059259
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	0.84 AC

Parcel Number	2725059199
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	0.99 AC

Parcel Number	2725059330
Land Use	Commercial - Office
Parcel Size	0.50 AC

Parcel Number	2725059191
Land Use	Commercial- Retail/Service
Parcel Size	3.54 AC

Parcel Number	2725059227
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	0.85 AC

Parcel Number	2725059226
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	1.04 AC

Parcel Number	2725059007
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	1.14 AC

Parcel Number	2725059122
Land Use	Commercial - Retail/Service & Commercial - Office
Parcel Size	1.14 AC

Parcel Number	2725059061
Land Use	Partial - No Displacements
Parcel Size	1.20 AC

Parcel Number	2725059328
Land Use	Partial - No Displacements
Parcel Size	0.53 AC

Affected Parcel
Partially Affected Parcel
Parcel
Site Plan
East Link Extension

N
0 0.25 Miles
0 0.25 Kilometers

Source: Aerial Imagery and Parcels, City of Bellevue, 2013; Site plans, Huitt Zollars, 2013

Path: K:\Projects_3\Huitt_Zollars\00329_12_ST_LightRail\mapdoc\EIS_Figures\CH3\3-2_Acquisitions\Fig_3_2_3_SR520_Parcels.mxd; User: 30481; Date: 8/25/2015

Figure F.2-3: SR 520 Alternative—Affected Parcels
Sound Transit Link Light Rail OMSF Final EIS

Table F.2-4. Potential Land Acquisition, Displacement, and Relocation of Existing Uses—Lynnwood Alternative

Parcel Number	Existing Land Use
01082800010100, 01082800010200, and 01082800010300	1 – Commercial Office
1082800010400	1 – Commercial Office
1067400000100	1 – Commercial Office 1 – Vacant
00608400300401 and 00608400300402	6 – Commercial Office
619500000102	1 – Vacant
00619500000301 and 00619500000300	1 – Industrial
608400300303	1 – Vacant
608400300300	1 – Industrial
608400400301	1 – Vacant
619500000900	2 – Commercial Retail/Service 1- Industrial
Total Displacements by Land Use	2 – Commercial Retail/Service 9 – Commercial Office 3 – Industrial 4 – Vacant

The Lynnwood Alternative site contains industrial uses, such as Connolly Ski Manufacturing and a sheet metal manufacturing operation. The site is also developed with a mid-rise office that is host to various State of Washington offices, such as the Children's Administration, Community Service Office, Division of Developmental Disabilities, Home and Community Services, and Division of Vocational Rehabilitation. The site also contains a single-story office/flex space development that is currently occupied by an engineering and law services firm. Vacant parcels make up the largest component of the land use at the site, which includes the planned district support center for the Edmonds School District.

Table F.2-5. BNSF Storage Tracks

Parcel Number	Existing Land Use
2825059182	Vacant (owned by Sound Transit)
Total Displacements by Land Use	1 – Vacant (owned by Sound Transit)

The BNSF Storage Tracks component of the Lynnwood Alternative consists of right-of-way currently under the ownership of Sound Transit and one vacant industrial parcel (previously occupied by the International Paper facility, which is also under the ownership of Sound Transit.

Parcel Number	1082800010100
Land Use	Commercial - Office
Parcel Size	0.77 AC

Parcel Number	1082800010200
Land Use	Commercial - Office
Parcel Size	0.77 AC

Parcel Number	1082800010300
Land Use	Commercial - Office
Parcel Size	0.77 AC

Parcel Number	1082800010400
Land Use	Commercial - Office
Parcel Size	0.77 AC

Parcel Number	1067400000100
Land Use	Commercial - Office & Vacant
Parcel Size	1.06 AC

Parcel Number	608400300401
Land Use	Commercial - Office
Parcel Size	1.79 AC

Parcel Number	608400300402
Land Use	Commercial - Office
Parcel Size	2.79 AC

Parcel Number	619500000102
Land Use	Vacant
Parcel Size	20.68 AC

Parcel Number	619500000301
Land Use	Industrial
Parcel Size	1.34 AC

Parcel Number	619500000300
Land Use	Industrial
Parcel Size	1.08 AC

Parcel Number	608400300300
Land Use	Industrial
Parcel Size	1.40 AC

Parcel Number	608400300303
Land Use	Vacant
Parcel Size	0.14 AC

Parcel Number	608400400301
Land Use	Vacant
Parcel Size	4.12 AC

Parcel Number	619500000900
Land Use	Commercial - Retail/Service & Industrial
Parcel Size	3.90 AC

Affected Parcels
204th St. SW ROW
Site Plan
Lynnwood Link Extension

N
0 500 Feet
0 100 Meters

Sources: Parcels, Snohomish County, 2013; Site plans, Huitt Zollars, 2013; Aerial imagery, Sound Transit, 2010

Figure F.2-4a: Lynnwood Alternative—Affected Parcels
Sound Transit Link Light Rail OMSF Final EIS

Figure F.2-4b: Lynnwood Alternative, BNSF Storage Tracks*—Affected Parcels
Sound Transit Link Light Rail OMSF Final EIS
*The BNSF Storage Tracks are Located in Bellevue
* No Affected Parcels

Appendix F.3

Visual Simulations and Key Observation Point Analysis

Appendix F.3
Visual Simulations and Key Observation Point Analysis

Table F.3-1. Operational Visual Impacts—Preferred Alternative and BNSF Modified Alternative

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: 120th Avenue NE	Low	**Current view:** Industrial facilities and warehouses (Photographs F.3-1 and F.3-7). **Effect:** Views of an industrial facility with rail storage and trains. The facility would be in the foreground for viewers along 120th Avenue NE. Initial views would be blocked at the south end for viewers traveling north. The upper portion of the OMSF and trains may be visible. The BNSF Modified Alternative would be set 200 feet farther back from the road than the Preferred Alternative and would allow for future development between the proposed project and the road that may screen some or all of the facility from this location. A 6-foot sight-obscuring fence would surround the site and partially obscure the view (Photographs F.3-2 and F.3-8). Viewers on the upper levels of the Spring District developments may have views of the site.	Low	Low	Low
B: 116th Avenue NE, Buildings facing the OMSF	Moderate	**Current view:** Industrial facilities and warehouses (Photographs F.3-3 and F.3-9). **Effect:** The OMSF would be in the foreground. The rear-facing offices are elevated above the site and would have a partially screened view of the facility under the Preferred Alternative. The BNSF Modified Alternative would be much closer to these offices and in the foreground. The view would not be substantially different than the current view (Photographs F.3-4 and F.3-10).	Moderate	Low	Moderate

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
C: NE 24th Street and NE 26th Place	Moderate	**Current view:** Industrial facilities and warehouses (Photographs F.3-5 and F.3-11). **Effect:** Views of an industrial facility with rail storage and trains, but the OMSF would be blocked from view for most of the neighborhood. The facility would be in the background as viewers travel south along NE 26th Place and approach NE 24th Street; it would be in the background to the left as viewers travel west along a short portion of NE 24th Street, from approximately 124th Avenue NE to NE 26th Place (Photographs F.3-6 and F.3-12).	Moderate	Low	Moderate
1: Northup Way	Low	**Current view:** Commercial developments. **Effect:** The proposed project would be blocked from view by buildings and landforms.	Low	No change	Low
2:116th Avenue NE, Main Road	Moderate	**Current view:** Office and commercial developments. **Effect:** The proposed project would be partially blocked from view by buildings and landforms.	Low	Moderate	Low
3:NE 12th Street	Moderate	**Current view:** Office and commercial developments. **Effect:** The proposed project would be blocked by buildings for most of NE 12th Street. Viewers may have fleeting views of the OMSF as they cross over the BNSF Storage Tracks. Viewers on the upper levels of the Spring District developments may have views of the site.	Moderate	Low	Moderate

Table F.3-2. Operational Visual Impacts—SR 520 Alternative

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: Northup Way	Moderate	**Current view:** Commercial developments (Photograph F.3-13). **Effect:** Views may include the upper portion of the facility and trains as viewers travel past the site. The facility would be in the foreground for viewers traveling along Northup Way (Photograph F.3-14).	Moderate	Moderate	Moderate
B: 132nd Avenue NE	Moderate	**Current view:** Commercial developments (Photograph F.3-15). **Effect:** Views of the proposed project and trains as viewers travel toward the site. The proposed project would be in the foreground for viewers at the intersection of 132nd Avenue NE and Northup Way (Photograph F.3-16).	Moderate	Moderate	Moderate
C: NE 20th Street east of the site	Low	**Current view:** Commercial developments (Photograph F.3-17). **Effect:** Views of the proposed project and trains as viewers travel toward the site. Viewers traveling west on NE 20th Street would see the site in the background from approximately west of the 148th Avenue NE to 140th Avenue NE (Photograph F.3-18).	Low	Low	Low
1:Bridle Trails Neighborhood	Moderate	**Current view:** Residential developments and trees. **Effect:** The proposed project is would be blocked from view by SR 520, landforms, and vegetation.	Moderate to High	No change	Moderate to High
2: Viewpoint Park	High	**Current view:** Residential developments and trees. **Effect:** The proposed project is would be blocked from view by SR 520, landforms, and vegetation.	High	No change	High

Table F.3-3. Operational Visual Impacts—Lynnwood Alternative

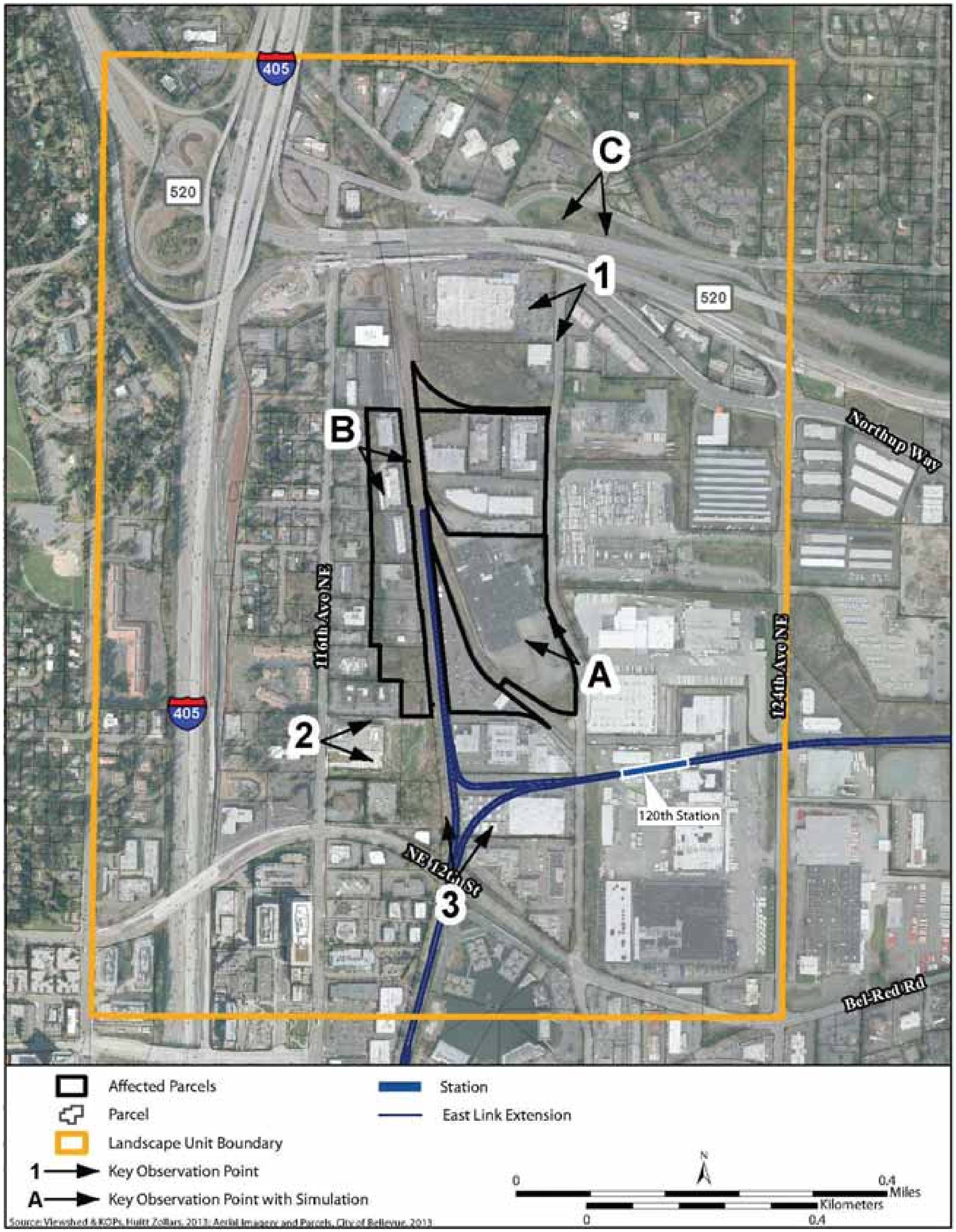
Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: Residential on 52nd Avenue W	High	**Current view:** Undeveloped, partially graded, and cleared property and office space (Photograph F.3-19). **Effect:** The Lynnwood Link Extension would begin construction during the construction of the proposed OMSF project. Its elevated guideway would not run along 52nd Avenue W. Viewers would see the tops of the OMSF, trains, and lead tracks. A 6-foot sight-obscuring fence would surround the site and partially obscure the view (Photograph F.3-20)	Moderate	Moderate	Moderate
B: Interurban Trail	Moderate	**Current view:** Undeveloped, partially graded, and cleared property (Photograph F.3-21). **Effect:** The proposed project would be in the background for viewers along the majority of the trail. As viewers approach the south end of the site, the proposed project would be in the foreground. The top of the OMSF, trains, and lead track may be visible to viewers. The site would be partially blocked by landforms. A 6-foot sight-obscuring fence would surround the site and partially obscure the view (Photograph F.3-22).	Moderate	Moderate to High	Moderate
C: I-5	Low	**Current view:** From I-5 southbound, intermittent views of the site, with undeveloped, partially graded, and cleared property visible. The view is primarily blocked by landforms and existing development. The view is blocked from viewers traveling north on I-5 (Photograph F.3-23). **Effect:** The Lynnwood Link Extension would begin construction during construction of the proposed project. The elevated guideway would dominate the view in the foreground and glimpses of upper portions of the building and trains may be visible (Photograph F.3-24).	Moderate	Low	Moderate

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
1: Industrial Facilities to the South	Low	**Current view:** Undeveloped, partially graded, and cleared property. **Effect:** The top of the facility, trains, and lead track may be visible to viewers. The lead tracks would be in the foreground. Proposed grading would lower the site below the existing grade. A 6-foot, sight-obscuring fence would surround the site and partially obscure the view.	Low	Low	Low
2: Scriber Creek Park	Moderate to High	**Current view:** Office buildings through the trees (intermittent views). **Effect:** Proposed grading would raise the site above the existing grade. Views of the fence, building, and trains would be partially visible through gaps in existing vegetation in the park.	Moderate to High	Moderate	Moderate to High

Table F.3-4. Operational Visual Impacts—Lynnwood Alternative (BNSF Storage Tracks)

Key Observation Point	Viewer Group Sensitivity	Changes in Landscape Elements	Existing Visual Quality	Degree of Change	Resulting Visual Quality
A: 120th Avenue NE	Low	**Current view:** Industrial facilities and warehouses (Photograph F.3-25). **Effect:** Views of a small office with covered platforms and trains on the existing BNSF tracks. The proposed project would be set back from the road and in the background for viewers along 120th Avenue NE. Initial views of the site would be blocked at the south end for viewers traveling north on 120th Avenue NE. The view would be partially blocked by vegetation for the length of the site in both directions (Photograph F.3-26). Viewers on the upper levels of the future Spring District development may have views of the site.	Low	Low	Low
B: 116th Avenue NE – Buildings facing the OMSF	Moderate	**Current view:** Industrial facilities and warehouses. **Effect:** Views of a small office with covered platforms and trains on the existing BNSF tracks. The proposed project would be in the foreground for these buildings; however, the view would not be substantially different than the current view.	Moderate	Moderate	Moderate
C: NE 24th Street and NE 26th Place	Moderate	**Current view:** Overview of industrial facilities, warehouses, and SR 520. **Effect:** View of the proposed project would be blocked by buildings and landforms.	Moderate	Low	Moderate
1:Northup Way	Low	**Current view:** Industrial facilities and warehouses. **Effect:** View of the proposed project would be blocked by buildings and landforms.	Low	No change	Low
2: 116th Avenue NE – Main Road	Moderate	**Current view:** Industrial facilities and warehouses. **Effect:** View of the proposed project would be blocked by buildings and landforms.	Moderate	No change	Moderate
3: NE 12th Street	Moderate	**Current view:** Industrial facilities and warehouses. **Effect:** Views of a small office, with covered platforms and trains on the existing BNSF tracks. View of the proposed project would be blocked by buildings from most of NE 12th Street. Viewers may have fleeting views of the proposed project as they cross the bridge over the BNSF Storage Tracks. Viewers on the upper levels of the Spring District developments may have views of the site.	Moderate	Low	Moderate

Figure F.3-1. Preferred Alternative, BNSF Modified Alternative, and BNSF Storage Tracks—Viewshed and KOPs



Photograph F.3-1. Preferred Alternative—KOP A, Existing View, 120th Avenue NE, Looking Northwest

Photograph F.3-2. Preferred Alternative—KOP A, Proposed View, 120th Avenue NE, Looking Northwest

Photograph F.3-3. Preferred Alternative—KOP B, Existing View, Offices at 116th Avenue NE, Looking Southeast

Photograph F.3-4. Preferred Alternative—KOP B, Proposed View, Offices at 116th Avenue NE, Looking Southeast

Photograph F.3-5. Preferred Alternative—KOP C, Existing View, 120th Avenue NE and NE 26th Place, Looking Southwest

Photograph F.3-6. Preferred Alternative—KOP C, Proposed View, 120th Avenue NE and NE 26th PL, Looking Southwest

Photograph F.3-7. BNSF Modified Alternative—KOP A, Existing View, 120th Avenue NE, Looking Northwest

Photograph F.3-8. BNSF Modified Alternative—KOP A, Proposed View, 120th Avenue NE, Looking Northwest

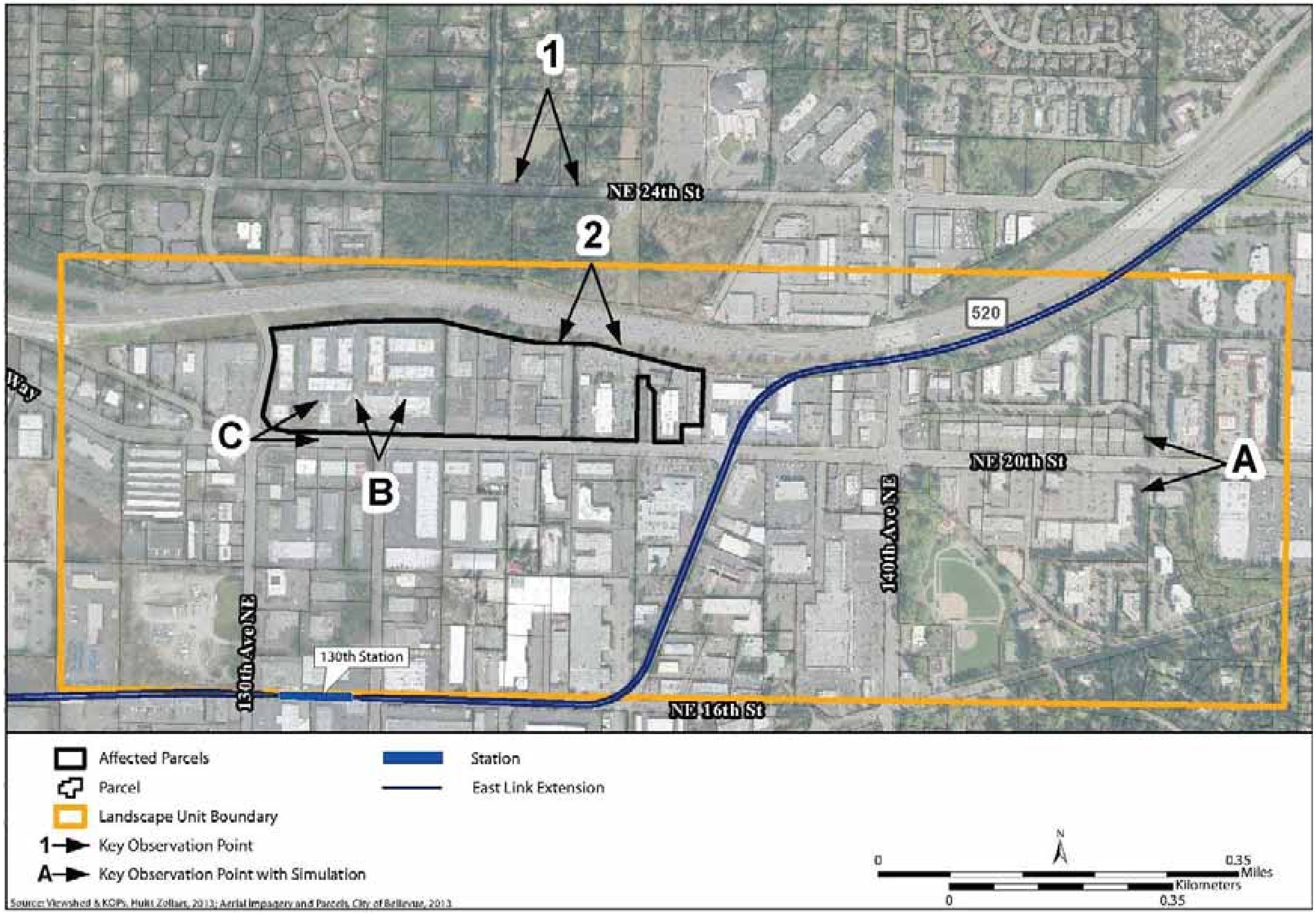
Photograph F.3-9. BNSF Modified Alternative—KOP B, Existing View, Offices at 116th Avenue NE, Looking Southeast

Photograph F.3-10. BNSF Modified Alternative—KOP B, Proposed View, Offices at 116th Avenue NE, Looking Southeast

Photograph F.3-11. BNSF Modified Alternative—KOP C, Existing View, 120th Avenue NE and 26th Place, Looking Southwest

Photograph F.3-12. BNSF Modified Alternative—KOP C, Proposed View, 120th Avenue NE and 26th Place, Looking Southwest

Figure F.3-2. SR 520 Alternative—Viewshed and KOPs



Photograph F.3-13. SR 520 Alternative—KOP A, Existing View, Northup Way near 148th Avenue NE, Looking West

Photograph F.3-14. SR 520 Alternative—KOP A, Proposed View, Northup Way near 148th Avenue NE, Looking West

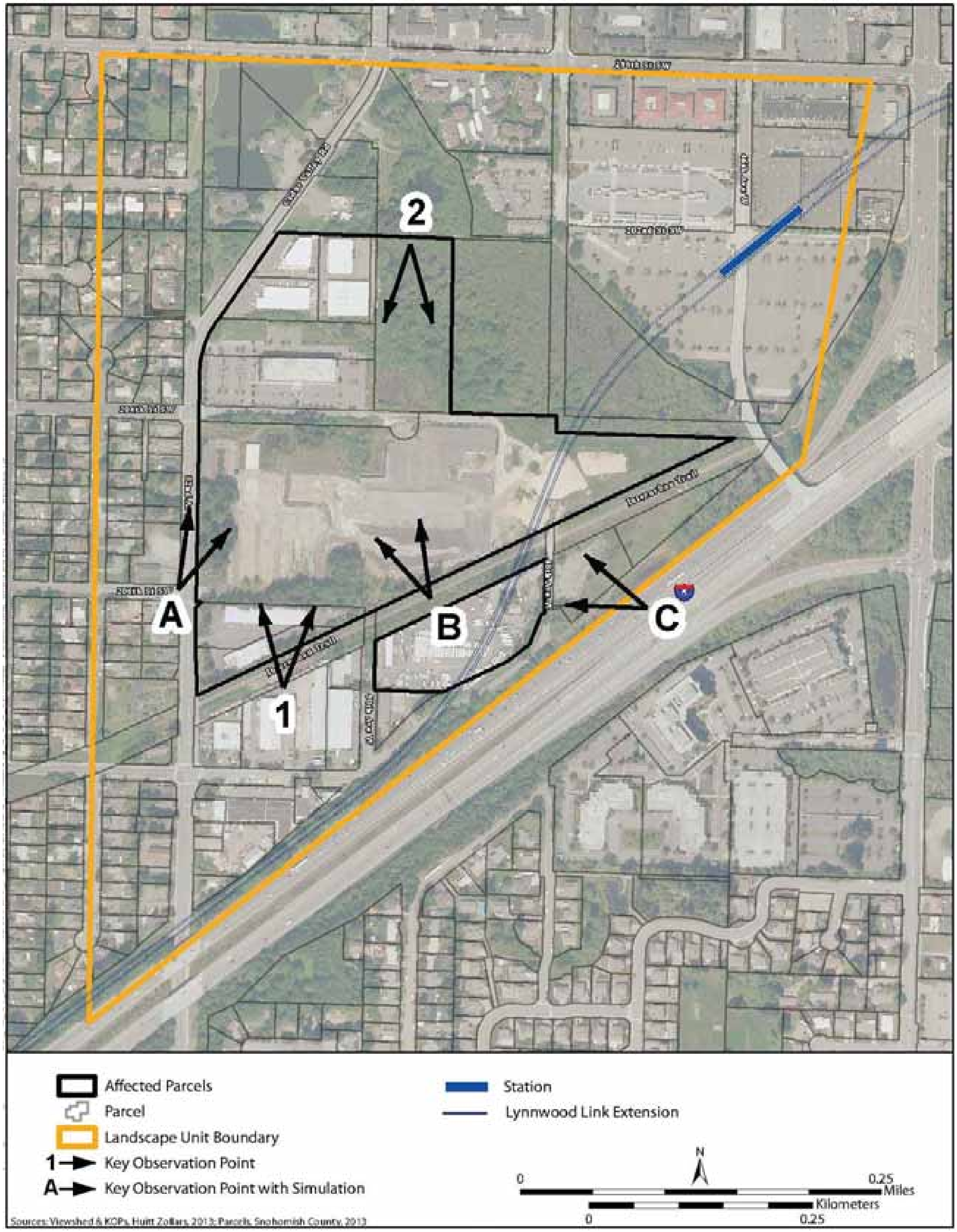
Photograph F.3-15. SR 520 Alternative—KOP B, Existing View, 132nd Avenue NE at Northup Way, Looking North

Photograph F.3-16. SR 520 Alternative—KOP B, Proposed View, 132nd Avenue NE at Northup Way, Looking North

Photograph F.3-17. SR 520 Alternative—KOP C, Existing View, Northup Way at 130th Avenue NE, Looking Northeast

Photograph F.3-18. SR 520 Alternative—KOP C, Proposed View, Northup Way at 130th Avenue NE, Looking Northeast

Figure F.3-3 Lynnwood Alternative—Viewshed and KOPs



Photograph F.3-19. Lynnwood Alternative—KOP A, Existing View, 52nd Avenue and 206th Street SW, Looking Northeast

Photograph F.3-20. Lynnwood Alternative—KOP A, Proposed View, 52nd Avenue and 206th Street SW, Looking Northeast

Photograph F.3-21. Lynnwood Alternative—KOP B, Existing View, Interurban Trail, Looking Northwest

Photograph F.3-22. Lynnwood Alternative—KOP B, Proposed View, Interurban Trail, Looking Northwest

Photograph F.3-23. Lynnwood Alternative—KOP C, Existing View, I-5, Looking Northwest

Photograph F.3-24. Lynnwood Alternative—KOP C, Proposed View, I-5, Looking Northwest

Photograph F.3-25. Lynnwood Alternative, BNSF Storage Tracks—KOP A, Existing View, 120th Avenue NE, Looking Northwest (Note: Same viewpoint location as Preferred Alternative and BNSF Modified Alternative KOP A as shown on Key Map 2)

Photograph F.3-26. Lynnwood Alternative, BNSF Storage Tracks—KOP A, Proposed View, 120th Avenue NE, Looking Northwest (Note: Same viewpoint location as Preferred Alternative and BNSF Modified Alternative KOP A as shown on Key Map 2)

Appendix F.4

Air Quality Analysis Details

Appendix F.4
Air Quality Analysis Details

Introduction

This appendix provides additional air quality and greenhouse gas (GHG) details to support the impact assessment provided in Section 3.7, *Air Quality and Greenhouse Gases*, of the Final Environmental Impact Statement (Final EIS). An expanded discussion of applicable regulatory requirements is provided, as well as information on criteria pollutants of concerns and existing pollutant concentrations in the study area. The appendix concludes with technical information on the approach and methodology used to assess construction and operational emissions associated with the proposed project.

Regulatory Agencies and Requirements

This section provides additional details on air quality and climate change regulations applicable to the proposed project.

Criteria Air Pollutants

Clean Air Act and Ambient Air Quality Standards

The Clean Air Act (CAA), promulgated in 1963 and amended several times thereafter, including the 1990 Clean Air Act amendments (CAAA), establishes the framework for modern air pollution control. The act directs the U.S. Environmental Protection Agency (EPA) to establish national ambient air quality standards (NAAQS) for the following six criteria pollutants: ozone, carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM), which consists of PM 10 microns in diameter or less (PM10) and PM 2.5 microns in diameter or less (PM2.5). The NAAQS are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety, and the latter to protect environmental values, such as plant and animal life. The Washington State Department of Ecology (Ecology) establishes state ambient air quality standards for the same six pollutants that are at least as stringent as the national standards. Table F.4-1 summarizes the NAAQS and state air quality standards.

Transportation Conformity Requirements

The CAAA and Washington State require all transportation projects located within maintenance and nonattainment areas to follow conformity regulations specified under federal (40 Code of Federal Regulations [CFR] 51,93) and state (Washington Administrative Code [WAC]-173-420) regulations. Maintenance areas are those where monitored pollutant concentrations previously exceeded one or more NAAQS, but are no longer in violation of that standard. Nonattainment areas are those where monitored pollutant concentrations consistently violate one or more NAAQS. Attainment areas, which include regions where pollutant concentrations meet the NAAQS, are not subject to transportation conformity.

Table F.4-1. National and Washington State Ambient Air Quality Standards

Pollutant	Federal Standard Primary	Federal Standard Secondary	State Standard
Carbon monoxide			
8-hour average[a]	9 ppm	No standard	9 ppm
1-hour average[a]	35 ppm	No standard	35 ppm
Ozone			
8-hour average[b]	0.075 ppm	0.075 ppm	0.075 ppm
Total suspended particles			
Annual average	No standard	No standard	60 μg/m^3
24-hour average[c]	No standard	No standard	150 μg/m^3
Particulate matter—PM10			
24-hour average[c]	150 μg/m^3	150 μg/m^3	150 μg/m^3
Particulate matter—PM2.5			
Annual average	15 μg/m^3	15 μg/m^3	15 μg/m^3
24-hour average[d]	35 μg/m^3	35 μg/m^3	35 μg/m^3
Lead			
Quarterly average	1.5 μg/m^3	1.5 μg/m^3	1.5 μg/m^3
Sulfur dioxide			
Annual average	0.03 ppm	No standard	0.02 ppm
24-hour average[a]	0.14 ppm	No standard	0.10 ppm
3-hour average[a]	No standard	0.50 ppm	No standard
1-hour average[e]	0.075 ppm	No standard	0.40 ppm
Nitrogen dioxide			
Annual average	0.053 ppm	0.053 ppm	0.05 ppm
1-hour average[f]	0.100 ppm	No standard	No standard

Source: WAC 173-470.

Notes:

Annual standards are never to be exceeded. Short-term standards are not to be exceeded more than once per year unless noted.

[a] Not to be exceeded once per year.

[b] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

[c] Not to be exceeded more than once per year on average over 3 years.

[d] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 μg/m^3.

[e] 0.25 ppm are not to be exceeded more than two times in 7 consecutive days.

[f] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.

ppm = parts per million; μg/m^3 = micrograms per cubic meter.

The intent of the conformity regulations is to ensure that transportation projects, plans, and programs affecting regional and local air quality conform to existing state implementation plans (SIP) and time tables for attaining and maintaining federal health-based air quality standards. Air quality–based criteria for demonstrating conformity to the SIP are developed by Washington State Department of Transportation (WSDOT).

EPA and Ecology designate regions as being attainment or nonattainment areas for regulated air pollutants based on monitoring information collected over a period of years. Attainment status indicates that air quality in an area meets the NAAQS; nonattainment status indicates that air quality in an area does not meet those standards. The proposed project area is currently designated a maintenance area for CO and an attainment area for all other criteria air pollutants (ozone, PM10, PM2.5, Pb, SO_2, and NO_2) (U.S. Environmental Protection Agency 2012a).

The proposed project is required to meet both regional and project-level conformity requirements. Regional conformity is met by demonstrating that the proposed project is included in a conforming regional transportation plan (RTP) and a regional transportation improvement program (RTIP). Project-level conformity is met through air quality dispersion modeling. The project-level analysis must demonstrate that the proposed project would not result in any of the following conditions.

1. Increase in the severity or frequency of existing violations of the CO NAAQS.
2. New violations of the CO NAAQS.
3. Delay the timely attainment of the CO NAAQS.

The permitting agency must demonstrate transportation conformity as part of the proposed project's environmental review process.

Puget Sound Clean Air Agency Regulations

All construction sites in the Puget Sound region are required to implement rigorous emissions controls to minimize fugitive dust and odors during construction, as required by Puget Sound Clean Air Agency (PSCAA) Regulation 1, Section 9.15, Fugitive Dust Control Measures. Industrial and commercial air pollutant sources are also required to register with PSCAA. Facilities with substantial emissions are required to obtain a Notice of Construction air quality permit before construction is allowed to begin. The application for this permit requires the facility to install best available control technology to reduce emissions, conduct computer modeling to demonstrate that the facility's emissions will not cause ambient concentrations to exceed the NAAQS limits, and minimize the impacts of odors and toxic air pollutants.

Greenhouse Gases

National Environmental Policy Act Guidance for Climate Change Analysis

On December 7, 2009, EPA signed the Endangerment and Cause or Contribute findings for GHGs under Section 202(a) of the CAA. Under the Endangerment Finding, EPA determines that the current and projected concentrations of the six key well-mixed GHGs (carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], perfluorocarbons [PFCs], hydrofluorocarbons [HFCs], and sulfur hexafluoride [SF_6]) in the atmosphere threaten the public health and welfare of current and future generations. Under the Cause or Contribute Finding, EPA determines that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare.

On February 19, 2010, the Council on Environmental Quality (CEQ) issued draft NEPA guidance on the consideration of the effects of climate change and GHG emissions. This guidance advises federal agencies to consider opportunities to reduce GHG emissions caused by federal actions, adapt their actions to climate change impacts throughout the NEPA process, and address these issues in their agency NEPA procedures. Where applicable, the scope of the NEPA analysis should cover the GHG emission effects of a proposed action and alternatives and the relationship of climate change effects to a proposed action or alternatives.

State of Washington Greenhouse Gas Initiatives

In response to growing worldwide concerns, Washington State Governor Christine Gregoire issued Executive Order 07-02 in February 2007. The executive order established the following GHG reduction limits.

- Reduce emissions to 1990 levels by 2020, 25% below 1990 levels by 2035, and 50% below 1990 levels by 2050.
- Increase “green economy jobs” to 25,000. The term *green economy jobs* means the design, manufacture, marketing, and installation of equipment to support sustainable development both within and beyond Washington State.
- Reduce expenditures on fuel imported into Washington State by 20% by 2020.

The above GHG reduction goals apply state-wide, but they do not specify any requirements for local government agencies to implement measures to reduce emissions within their local jurisdictions. The GHG reduction goals established by Executive Order 07-02 were codified by RCW 70.235, which identifies the goals as “limits.” The new law also adds a fourth requirement to decrease the annual per capita vehicle miles traveled 18% by 2020, 30% by 2035, and 50% by 2050.

Ecology has issued guidance for the State Environmental Policy Act (SEPA) reviews related to GHG emissions, for SEPA actions for which a local government agency is the SEPA lead agency. That guidance indicates all SEPA reviews must evaluate GHG emissions. The guidance presents a range of ways that local agencies could set significance thresholds and calculate GHG emissions and potentially mitigate those emissions. However, the guidance does not stipulate what GHG significance threshold must be used, nor does it specify what level of GHG emission reductions is required under SEPA. The guidance emphasizes those decisions must be made by the SEPA lead agency on a case-by-case basis.

In 2012, the Washington State Department of Commerce released an updated Washington State Energy Strategy (Washington State Department of Commerce 2012), which includes short- and long-term policy options to meet several emissions reduction goals. The Washington State Energy Strategy outlines strategies for meeting these goals in the categories of transportation efficiency, building efficiency, distributed energy and pricing.

Puget Sound Clean Air Agency GHG Guidance

In 2004, PSCAA published its strategy document for climate change, entitled *Roadmap for Climate Protection: Reducing Greenhouse Gas Emissions in Puget Sound* (Puget Sound Clean Air Agency 2004). In this strategy document, PSCAA recommended a broad range of GHG reduction measures, including regional vehicle trip reduction, building energy efficiency improvements, solid waste reduction, forestry and agriculture practice improvements, and community education. This document also encouraged local municipalities to establish their own GHG reduction measures; however, it did not propose a SEPA significance threshold for GHG emissions, nor did it require local governments to impose future mitigation measures for future development projects for which the municipality is the SEPA lead agency. Regardless, this document illustrates the importance of local government actions to reduce GHG emissions.

Existing Air Quality Conditions

This section provides additional information of key air pollutants of concern, toxic air contaminants, and ambient air quality monitoring trends in the study area for the proposed project. The study area for this analysis is the metropolitan Puget Sound region. The proposed project would be located between the Cities of Bellevue and Lynnwood. Air quality conditions in the study area provide a baseline for evaluating the impacts of the proposed project.

Air Pollutants of Concern

The following discussion describes the sources and environmental effects of key criteria pollutants (CO, ozone, and PM) considered in this analysis.

CO is a product of incomplete combustion generated by mobile sources, residential wood combustion, and industrial fuel-burning sources. CO is a concern related to on-road mobile sources because it is the pollutant emitted in the greatest quantity for which short-term health standards exist. CO is a pollutant whose impact is usually localized, and CO concentrations typically diminish within a short distance of roads. The highest ambient concentrations of CO usually occur near congested roadways and intersections during wintertime periods of air stagnation.

Ozone is a highly reactive form of oxygen created by an atmospheric chemical reaction of nitrogen oxides (NO_X) and reactive organic gases (ROG), both of which are emitted directly from industrial and mobile sources. Ozone problems tend to be regional in nature because the atmospheric chemical reactions that produce ozone occur over a period of time, and because, during the delay between emission and ozone formation, ozone precursors can be transported far from their sources. Vehicles such as automobiles and trucks are some of the sources that produce ozone precursors.

PM is generated by industrial emissions, residential wood combustion, motor vehicle tailpipes, and fugitive dust from roadways and unpaved surfaces. When first regulated, particle pollution was based on “total suspended particulate,” which included all size fractions. As sampling technology has improved and the importance of particle size and chemical composition has become clearer, ambient standards have been revised to focus on the size fractions thought to be most dangerous to people. At present, there are standards for PM10 and PM2.5, because these sizes of particulate contribute the most to human health effects, regional haze, and acid deposition. The highest ambient concentrations generally occur near the emissions sources, which in the vicinity of the proposed project area would be motor vehicle tailpipes from I-5 and major roads. PM2.5 has a greater impact than PM10 at locations far from the emitting source, because it remains suspended in the atmosphere longer and travels farther.

Air Toxics and Hazardous Air Pollutants

Air toxics are pollutants that may result in an increase in mortality or serious illness, or that may pose a present or potential hazard to human health. Health effects of air toxics include cancer, birth defects, neurological damage, damage to the body’s natural defense system, and diseases that lead to death. The CAA identifies 188 air toxics, also known as hazardous air pollutants (HAPs). In its latest rule on the control of HAPs from mobile sources (Federal Register [FR], volume 72, page 8430), EPA identified a group of 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System (IRIS). From this list of 93 compounds, the EPA has identified seven as priority mobile source air toxics (MSATs). The high regulation priority of these seven MSATs was based on the EPA 1999 National Air Toxics Assessment (NATA).

- Acrolein
- Benzene
- 1,3-butadiene
- Diesel particulate matter/diesel exhaust organic gases
- Formaldehyde
- Naphthalene
- Polycyclic organic matter

Air Quality Monitoring and Trends

The existing air quality conditions in the proposed project area can be characterized by monitoring data collected in the region. PSCAA monitors criteria pollutant concentrations at several sites throughout Puget Sound. Table F.4-2 summarizes data for criteria air pollutant levels from the

Table F.4-2. Ambient Air Quality Monitoring Data at the Seattle Beacon Hill South Monitoring Station

Pollutant Standards	2010	2011	2012
Ozone			
Maximum 1-hour concentration (ppm)	0.056	0.059	0.063
Maximum 8-hour concentration (ppm)	0.044	0.046	0.049
Number of days standard exceeded[a]			
NAAQS 8-hour (>0.075 ppm)	0	0	0
Carbon monoxide (CO)			
Maximum 1-hour concentration (ppm)	1.2	1	1
Maximum 8-hour concentration (ppm)	0.8	0.9	0.7
Number of days standard exceeded[a]			
NAAQS 1-hour (≥35 ppm)	0	0	0
NAAQS 8-hour (≥9 ppm)	0	0	0

Source: U.S. Environmental Protection Agency 2012b.

[a] An exceedance is not necessarily a violation.

NAAQS = national ambient air quality standards; ppm = parts per million.

Seattle Beacon Hill South monitoring station. Air quality concentrations are expressed in terms of parts per million (ppm) or micrograms per cubic meter (µg/m3). The last 3 years (2010 through 2012) of data collected at the minoring station indicated that pollutant concentrations have not exceeded the NAAQS.

Air Quality Analysis Methods

This section discusses the approach and methods used to quantify construction and operational emissions associated with the proposed project.

Construction

Criteria Pollutants

Criteria pollutants associated with the construction phase of the proposed project would result from the exhaust emissions of on-road and off-road vehicles and construction equipment, as well as the particulate matter released into the local air shed from dust from earthmoving activities and diesel combustion. To be consistent with the methodology used in calculating construction-related criteria pollutants in the *East Link Project Final Environmental Impact Statement* (*East Link Project Final EIS)* (Sound Transit 2011) and due to the lack of specific construction equipment and phasing information, the *Road Construction Emissions Model Version 7.1.2,* which was developed by the Sacramento Air Quality Management District (SAQMD)(2012) was used to model construction emissions. Although the model is specifically designed for roadway construction, the model provides a description of the potential magnitude of construction emissions.

Available project data from the construction consultants included specific information about the disturbed surface area, the quantity of cut-and-fill material, and the construction duration period for each alternative. The model's defaults were used for the number and types of project construction equipment needed, the number of construction workers commuting to the job sites, and the length of their commute. The overall period from start of construction and operation of the proposed project was assumed to range between 34 and 45 months, or approximately 3 to 4 years.

Greenhouse Gas Emissions

GHGs associated with the construction phase of the proposed project use the same methods as for a prototypical Sound Transit maintenance facility analyzed in the *East Link Project Final EIS* (Sound Transit 2011). In large-scale construction projects, the major sources of GHG emissions are fossil-fueled construction equipment (mobile and stationary). The amount of GHG emissions produced by fossil-fueled construction equipment is directly proportional to the quantity of fuel used. It was conservatively assumed that all of the fossil fuel used during construction would be diesel. The CO_2e factor for diesel used in the analysis is from The Climate Registry's default emission factors (The Climate Registry 2012).

The construction fuel usage is taken from estimates for a similar maintenance facility modeled for the East Link project. These estimates consisted of fuel used in the transport of construction materials, waste, and fill material for the Sound Transit maintenance facility. The estimated material use for the maintenance yards, buildings, elevated guideways and/or lead tracks, and storage tracks as well as associated transport fuel use was originally provided by Douglas King of Sound Transit as part of the East Link analysis (Hale pers. comm.). The original calculations used for the East Link analysis were scaled by the square footage of the maintenance yards (paved areas) and buildings to reflect the different areas for each of the four build alternatives.

To simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the global warming potential (GWP) methodology defined in the Intergovernmental Panel on Climate Change (IPCC) (1996 and 2001) reference documents. The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2 equivalent (CO_2e), which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). GHG emissions generated by construction were translated to CO_2e using the GWPs presented in Table 3.

Operational Emissions

The two primary sources of operational emissions associated with the proposed project include energy consumption (natural gas and electricity) and vehicle trips. Because the differences in alternatives are mainly in project siting and the Forest Street OMF is used as a proxy for all alternatives[1].

[1] The operational activities for all of the build alternatives are assumed to be similar to those at the Forest Street OMF. No vehicle painting would occur at the proposed OMSF.

Table F.4-3. Lifetimes and Global Warming Potentials of CO_2, CH_4, N_2O, and SF_6

Greenhouse Gases	Global Warming Potential (100 years)	Lifetime (years)	2005 Atmospheric Abundance
CO_2 (ppm)[a]	1	50–200	379
CH_4 (ppb)	21	9–15	1,774
N_2O (ppb)	310	120	319
SF_6 (ppt)[a]	23,900	5.6	5.6

Source: Intergovernmental Panel on Climate Change 1996, 2001.
ppm = parts per million by volume; ppb = parts per billion by volume; ppt = parts per trillion by volume.

Natural gas emissions were calculated by applying natural gas combustion emission factors (pounds of pollutant per therm) for small boilers and residential space and water heaters.[2] The natural gas GHG emission factors were from the Climate Registry 2012 default emission factors (Climate Registry 2012: Tables 12.1 and 12.9). Natural gas criteria pollutant factors were from EPA's AP42, Fifth Edition, Chapter 1.4 (U.S. Environmental Protection Agency 1998).

Indirect CO_2 emissions from electricity were calculated by applying utility-specific emission factors (pounds per kilowatt-hours [kWh]) for the Snohomish County Public Utilities District (SnoPUD) and Puget Sound Energy (PSE) to the annual kWh consumed for operations at the Forest Street OMF, which is being used as a proxy for the proposed OMSF project (Burrell pers. comm.). It was assumed that PSE would provide electricity for the Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative, and SnoPUD would provide electricity for the Lynnwood Alternative. Emission factor data for CH_4 and N_2O were not available for SnoPUD or PSE. Accordingly, average GHG emission factors for EPA's eGrid Western Electric Coordinating Council (WECC) Northwest Power Pool (NWPP) subregion were used to calculate CH_4 and N_2O emissions for all alternatives (U.S. Environmental Protection Agency 2012c). Criteria pollutants from electricity were not evaluated here due to the state and federal permitting requirements that already address and mitigate emissions from electricity generators themselves.

For GHG emissions from vehicle trips, the California Emissions Estimator Model (CalEEMod Version 2011.1.1), developed by Environ International Corporation and the South Coast Air Quality Management District (SCAQMD), was used to quantify these emissions. Although the vehicle trips are located in Washington State, the Seattle metropolitan area was modeled as the similarly urban San Francisco County within CalEEMod, as data from the Puget Sound Regional Council indicates the average worker commute for the Puget Sound Region is 12.8 miles (Puget Sound Regional Council 2007), which is consistent with the default trip length assumed by CalEEMod for San Francisco, which is 12.4 miles (South Coast Air Quality Management District 2011). The number of trips was provided by Appendix E.1, *Transportation Technical Report*, of the Final EIS, which assumed that the trip rate did not change between the Preferred Alternative, BNSF Modified Alternative, and SR 520

[2]Sources of natural gas used at the Forest Street OMF include the hot water pressure washers, hot water heater, boilers for office heat, an air handling unit, and gas overhead heaters. No quantities were provided as to the amount of natural gas used per source. It was assumed, using AP42 categories that the natural gas emission factors would reflect 50% small boilers and 50% residential heaters, based on the provided description of natural gas combustors.

Alternative. Table F.4-4 summarizes the estimated energy and vehicle trip data for the proposed project, as well as corresponding emissions.

Table F.4-4. Annual Operational Criteria Pollutant and GHG Emissions Common to all Build Alternatives

			Annual Emissions (lbs/day)					
OMSF Operations	**Unit**	**Value**	**ROG**	**NO_X**	**CO**	**PM10**	**PM2.5**	**CO_2e**
Natural Gas[a]	Therms/yr	60,673 65,830	0.09	1.61	1.40	0.13	-	322
Electricity (Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative)	kWh/yr	8,416,274	-	-	-	-	-	3,287
Electricity (Lynnwood Alternative)	kWh/yr	8,416,274	-	-	-	-	-	399
Vehicle Trips (Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative)[b]	Trips/day	570	1.46	2.33	10.36	5.71	0.26	593
Vehicle Trips (Lynnwood Alternative)[b]	Trips/day	650	1.33	2.12	9.43	5.19	0.24	540
Total (Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative)[c]			**1.55**	**3.94**	**11.76**	**5.84**	**0.26**	**4,202**
Total (Lynnwood Alternative)[c]			**1.42**	**3.73**	**10.83**	**5.32**	**0.24**	**1,261**

Sources: Sound Transit 2012; United States Environmental Protection Agency 1998; South Coast Air Quality Management District 2011.

lbs/day = pounds per day; kWh/yr = kilowatt hours per year.

[a] 65,830 assumed for Lynnwood Alternative (includes the BNSF Storage Tracks) and 60,673 assumed for all other build alternatives. Assumes 50% of therms are used in uncontrolled small boilers and 50% used as uncontrolled "residential heating" to be conservative. Emission factors from EPA AP42 Tables 1.4-1 and 1.4-

[b] Assume vehicle mix is equal to that of the Unrefrigerated Rail-Warehouse land use category in CalEEMod.

[c] Criteria pollutants from electricity were not evaluated due to state and federal permitting requirements that already address and mitigate emissions from power producers throughout the state. Volatile organic compound emissions from evaporative loses were not quantified due to lack of data.

References

Printed References

Intergovernmental Panel on Climate Change (IPCC). 1996. 1995: Science of Climate Change. (Second Assessment Report). Cambridge, U.K.: Cambridge University Press.

———. 2001. Atmospheric Chemistry and Greenhouse Gases. In Climate Change 2001: Working Group I: The Scientific Basis. Available: http://www.ipcc.ch/ipccreports/tar/wg1/pdf/TAR-04.PDF. Accessed: September 22, 2009.

Puget Sound Clean Air Agency (PSCAA). 2004. Roadmap for Climate Protection: Reducing Greenhouse Gas Emissions in Puget Sound. Available: http://www.pscleanair.org/programs/climate/rptfin.pdf. Accessed: May 1, 2013.

Puget Sound Regional Council (PSRC). 2011. Puget Sound Trends: Average Distance to Work. Available: http://www.psrc.org/assests/817/trend-t10.pdf. Accessed: October 21, 2013.

Sacramento Air Quality Management District (SAQMD). 2012. Road Construction Emissions Model Version 7.1.2. Available: http://airquality.org/ceqa/. Accessed: May 1, 2013.

South Coast Air Quality Management District (SCAQMD). 2011. California Emissions Estimator Model. Available: http://www.caleemod.com/. Accessed: May 1, 2013.

The Climate Registry. 2012. Default Emission Factors. Last Revised: January 6, 2012. Available: http://www.theclimateregistry.org/downloads/2012/01/2012-Climate-Registry-Default-Emissions-Factors.pdf. Accessed: May 1, 2013.

U.S. Environmental Protection Agency (EPA). 1998. Emission Factors & AP 42, Compilation of Air Pollutant Emission Factors. Available: http://www.epa.gov/ttnchie1/ap42/. Accessed: May 1, 2013.

———. 2012a. The Green Book Nonattainment Areas for Criteria Pollutants. Last Revised: December 14, 2012. Available: http://www.epa.gov/oar/oaqps/greenbk/. Accessed: May 1, 2013.

———. 2012b. National Ambient Air Quality Standards. Last Revised: December 14, 2012. Available: http://www.epa.gov/air/criteria.html. Accessed: May 1, 2013.

———. 2012c. eGrid. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html. Accessed: May 1, 2013.

Washington State Department of Commerce. 2012. Washington State Energy Strategy. Available: http://www.commerce.wa.gov/Documents/EO-2012-State-Energy-Strategy-exec-summary.pdf. Accessed: May 1, 2013.

Personal Communication

Burrell, Angela. Policy Research Analyst. Washington State Department of Commerce. May 6, 2013—Email message to Laura Yoon, ICF International.

Hale, Kent. Senior Environmental Planner. Sound Transit. March 11, 2013—Email to Bill Bumback of ICF International regarding the natural gas and electricity use in 2012 at the Forest Street Operations Maintenance Facility.

Appendix F.5

Urban Land Institute Advisory Services Panel Report

A ULI Advisory Services Panel Report

Seattle Washington

March 3–6, 2014

Urban Land Institute

A ULI Advisory Services Panel Report

Seattle Washington

Sound Transit Operations and Maintenance Satellite Facility

March 3–6, 2014

ULI Urban Land Institute

About the Urban Land Institute

THE MISSION OF THE URBAN LAND INSTITUTE is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI is committed to

- Bringing together leaders from across the fields of real estate and land use policy to exchange best practices and serve community needs;
- Fostering collaboration within and beyond ULI's membership through mentoring, dialogue, and problem solving;
- Exploring issues of urbanization, conservation, regeneration, land use, capital formation, and sustainable development;
- Advancing land use policies and design practices that respect the uniqueness of both built and natural environments;
- Sharing knowledge through education, applied research, publishing, and electronic media; and
- Sustaining a diverse global network of local practice and advisory efforts that address current and future challenges.

Established in 1936, the Institute today has more than 32,000 members worldwide, representing the entire spectrum of the land use and development disciplines. ULI relies heavily on the experience of its members. It is through member involvement and information resources that ULI has been able to set standards of excellence in development practice. The Institute has long been recognized as one of the world's most respected and widely quoted sources of objective information on urban planning, growth, and development.

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About ULI Advisory Services

THE GOAL OF THE ULI ADVISORY SERVICES program is to bring the finest expertise in the real estate field to bear on complex land use planning and development projects, programs, and policies. Since 1947, this program has assembled well over 400 ULI-member teams to help sponsors find creative, practical solutions for issues such as downtown redevelopment, land management strategies, evaluation of development potential, growth management, community revitalization, brownfields redevelopment, military base reuse, provision of low-cost and affordable housing, and asset management strategies, among other matters. A wide variety of public, private, and nonprofit organizations have contracted for ULI's advisory services.

Each panel team is composed of highly qualified professionals who volunteer their time to ULI. They are chosen for their knowledge of the panel topic and screened to ensure their objectivity. ULI's interdisciplinary panel teams provide a holistic look at development problems. A respected ULI member who has previous panel experience chairs each panel.

The agenda for a three-day panel assignment is intensive. It includes an in-depth briefing day composed of a tour of the site and meetings with sponsor representatives; a day of hour-long interviews of typically 30 to 40 key community representatives; and one day of formulating recommendations.

Long discussions precede the panel's conclusions. On the final day on site, the panel makes an oral presentation of its findings and conclusions to the sponsor. A written report is prepared and published.

Because the sponsoring entities are responsible for significant preparation before the panel's visit, including sending extensive briefing materials to each member and arranging for the panel to meet with key local community members and stakeholders in the project under consideration, participants in ULI's five-day panel assignments are able to make accurate assessments of a sponsor's issues and to provide recommendations in a compressed amount of time.

A major strength of the program is ULI's unique ability to draw on the knowledge and expertise of its members, including land developers and owners, public officials, academics, representatives of financial institutions, and others. In fulfillment of the mission of the Urban Land Institute, this Advisory Services panel report is intended to provide objective advice that will promote the responsible use of land to enhance the environment.

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Contents

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Foreword: The Panel's Assignment

SOUND TRANSIT, THE CENTRAL Puget Sound Regional Transit Authority, is in the process of adding five new extensions to its Link light-rail system, in the second phase of the system's development. These lines will join the Central Link/Airport, from downtown Seattle to Seattle-Tacoma International Airport, which began service in 2009. The second phase will extend light-rail service from Seattle in three directions: north to Lynnwood, east to Redmond, and south to the Kent and Des Moines area. Together, the first and second phases will bring a total of 50 miles of light rail to the region by 2023.

The expansion of the Link light-rail system supports regional long-range plans for transportation and development, including those adopted by the Puget Sound Regional Council. Like Sound Transit's Regional Transit Long-Range Plan, the council puts a high priority on transit-oriented development and economic development in connection with the system. The Central Puget Sound is already the eighth most congested region in the country, so transportation alternatives are critical to its future viability.

Sound Transit's transit-oriented development policy supports land development that integrates transit and land use, promoting ridership while advancing community development visions. These visions typically include walkable communities and reduced need for driving, along with improved access to jobs and economic opportunities. Concurrent goals include reductions in regional traffic congestion, air pollution, and greenhouse gas emissions. In pursuit of all these values, Sound Transit seeks cooperation and partnerships with public and private entities.

To complete its expansion, Sound Transit must increase its light-rail vehicle fleet to about 180 vehicles by 2023. This will almost triple the number of vehicles now in service, requiring additional operations and maintenance capacity to be in place by 2020. Operations and maintenance satellite facilities (OMSFs) for these links will join the original light-rail operations and maintenance facility, which is in an industrial area south of downtown Seattle. Sound Transit's 25-acre Forest Street Operations and Maintenance (O&M) Facility is sized and configured to store and service 104 vehicles; it has been recognized for design excellence.

Although the OMSFs are necessary and consistent with sustainable development and overall environmental goals, they are inherently industrial, and the tracks used to move and store vehicles occupy acreage that cannot be integrated with a typical urban street grid. This makes OMSFs practically and politically difficult to accommodate and puts them at odds with some goals for transit-oriented and economic development—especially the overall goal of walkable communities, residential neighborhoods, and mixed-use development around transit.

Regional map.

Sound Transit is in the process of adding five new extensions to its Link light-rail system.

Sound Transit has identified four possible sites for new OMSFs based on their physical and operational requirements. These sites, in the cities of Lynnwood and Bellevue, are near light-rail segments along the phase two line extensions, in locations that would not compromise light-rail service. They can be in use during the nightly service window of 1:00 a.m. to 5:00 a.m. The sites are generally rectangular and include 20 to 25 acres of land. They can each accommodate at least 80 vehicles.

The four sites under consideration are:

- Alternative 1: Lynnwood with Burlington Northern Santa Fe Railroad (BNSF) storage tracks in Bellevue
- Alternative 2: SR520 site, Bellevue
- Alternative 3: BNSF site, Bel-Red neighborhood of Bellevue
- Alternative 4: BNSF site, modified

The panel was not asked to select the best site, but rather to look at each site and provide recommendations and thoughts on how to make it the best in terms of neighborhood impact, community and economic development, and other factors. Specifically, the sponsor asked the panel to address the following issues:

- What strategies could Sound Transit consider to help integrate an OMSF into the surrounding land use at each location?
- What potential opportunities exist for transit-oriented development and/or economic development on the surplus property associated with each site?
- What insights and suggestions does the ULI panel have regarding the potential for constructing housing or commercial uses over a public facility?
- What options or strategies should Sound Transit consider to encourage transit-oriented or other economic development opportunities adjacent to light-rail O&M facilities and nearby station areas?

The panel had access to a study recently conducted by Kidder Mathews Consulting for Sound Transit to provide decision makers with a market assessment of the potential for transit-oriented development adjacent to the future OMSF sites.

Like many developments, the proposed OMSF is meeting resistance and likely to see more. Because of the essentially industrial nature of the facility, its size, and its connection with transportation and trains, nearby residents have often made inaccurate assumptions about its impact on a neighborhood. Chief among the complaints are noise, light, traffic, air pollution, and 24-hour activity.

However, an OMSF does not pose the same noise issues as heavy rail or even facilities for motorized vehicles, largely because the vehicles are powered by electricity and are therefore quieter, but also because of the design of light-rail vehicles and facilities. Light can be tightly controlled through design and behavior so as to be sensitive to surrounding land uses, including residential ones. Although the OMSF will bring over 200 employees to the site in a 24-hour period, they primarily travel outside the peak travel hours.

Although such a facility serves a needed and environmentally sustainable transit system, it does take land out of development and may interrupt the pattern of streets in a community. There are opportunity costs associated with the location of an OMSF which, though real, should be understood in the context of larger forces that have a great impact on the development of cities and urban neighborhoods, including the positive impact of transit itself. Opportunity cost is hard to calculate over time, especially because transit-oriented development around light-rail stations is essential to the economic and environmental health of the region but can take 20 years or more to build out. Municipalities adapt zoning codes and incentive provisions to the ongoing course of development, including the locations of light-rail storage and maintenance facilities. All these issues have been taken into consideration in the panel's recommendations.

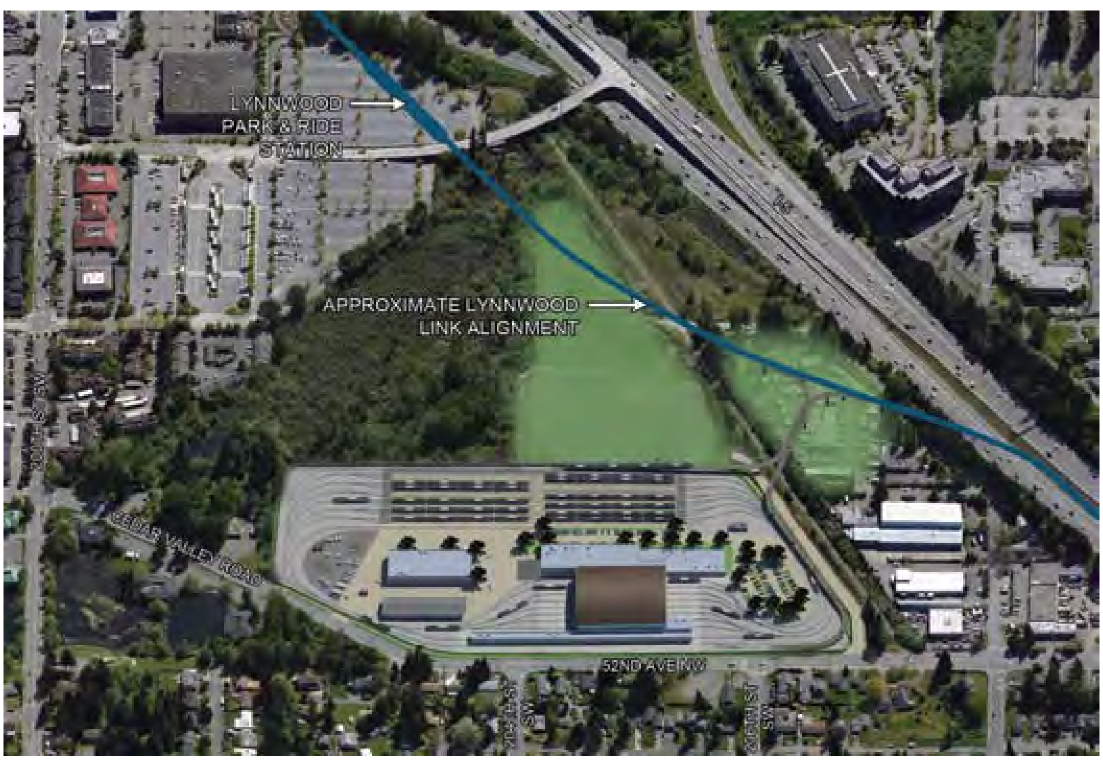
Primary Recommendations

THE PANEL CONSIDERED the four alternatives now being studied by Sound Transit, all of which could satisfy the functional requirements for OMSF: Lynnwood, SR520, BNSF, and BNSF Modified. The Lynnwood site is coupled with use of the BNSF storage tracks in Bellevue. A total of 32 light-rail vehicles (8 four-car trains) would need to be stored on the east side in Bellevue in order to begin service at 5:00 a.m. In the process of analyzing these alternatives, the panel identified a fifth alternative, BNSF Hybrid. Each offers special challenges and opportunities, which are summarized in the following subsections.

Lynnwood

Alternative 1 is located in the city of Lynnwood, between the Interstate 5 corridor, the arterial 52nd Avenue West, and residential areas south and east of the designated Lynnwood City Center. The proposed OMSF site offers strong opportunities for OMSF development in an appropriate area conforming to existing land use, but the site's significant challenges stem from one of the current owners—the Edmonds School District—and its plans for the site.

The school district plans to build 60,000 square feet of administrative offices, locate its food distribution services there, and build a major bus storage and maintenance facility in the approximate geographic center of the site. Although the construction timeline for additional district facilities on or near the proposed OMSF footprint is unclear, use of the site for an OMSF would require active negotiation and cooperation between Sound Transit and



Alternative 1 is located in the city of Lynnwood, between the Interstate 5 corridor, the arterial 52nd Avenue West, and residential areas south and east of the designated Lynnwood City Center.

the district. Although there could be mutual advantages to co-development and adjacency, there has been no indication that the Edmonds School District is interested in negotiating.

Part of the site is planned to be used for school bus storage on a surface parking lot. This use conforms with current zoning but conflicts with adjacent neighborhood desires for clean air and presumably with the goals for the city of Lynnwood, which include ample pedestrian access to the nearby bus transit station and to the adjacent Interurban Trail. Siting an OMSF here would help to ensure clean air in the adjacent neighborhood without presenting any new disadvantages. It would not carry opportunity costs because there is currently only very limited pedestrian access to the identified center of Lynnwood and the site presents no special opportunities for activation of that center.

Given these conditions and constraints, siting an OMSF in Lynnwood presents a number of opportunities for environmental preservation and enhancement.

Enhanced green space. Along with site planning for an OMSF, a swath of trees growing along the east side of the site could be protected and enhanced. This would provide a buffer between the residential community and the OMSF as well as an amenity and scenic resource for the area. It could add value to the Interurban Trail that passes by the site as well as a link to this important recreational and natural resource.

New funding source for the school district. There is a good opportunity for shared resources and codevelopment in an administration building that would provide new office space for the district at much lower cost than would be possible otherwise. In that sense, colocation with Sound Transit could be a funding opportunity for the school district. It would, however, require revisiting and revising school district plans and perhaps reframing programmatic needs so that the transit agency and school district could be accommodated in the codevelopment.

Support for Lynnwood development goals. The city of Lynnwood might be expected to support this cooperation because it would create a more densely developed site and quality open space, while supporting goals for transit, transit-oriented development, and the emergent Lynnwood City Center.

The challenges of the competing site needs of the Edmonds School District and Sound Transit could be overcome if a partnership were actively pursued that allowed both organizations to achieve their programmatic objectives. Although the school district has already made significant investments in the site, property cost differences between Lynnwood and Bellevue would result in potential savings for Sound Transit, even accounting for compensating the school district and investing in a transit-oriented structure to house the administrative offices. In addition, shifting some school district functions across the street to the parcel under the elevated tracks would create value for a site with limited functionality.

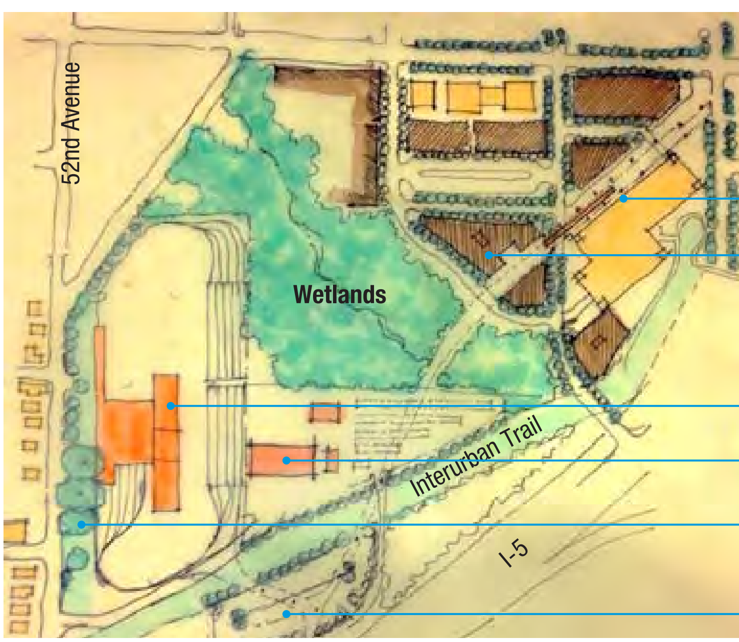
Legal channels for land condemnation from one public entity to another are unclear for this particular site but would no doubt produce significant political challenges and potential community opposition if Sound Transit were to pursue land acquisition without a willing partner in the school district. The preferred option would be for Sound Transit to engage the school district in developing a plan that is attractive to both public entities and could result in a willing partnership that would accommodate school and transit needs, as well as instill community confidence that the land is being designed for its highest and best use to serve public interests.

There is always the possibility of completely relocating the school district to an alternative property, as the school district does not have the same physical constraints as Sound Transit (i.e., the need to be located within access of the fixed light-rail tracks). However, the remaining portion of land that would be surplus to Sound Transit is not currently suited to high-density development and would face some challenges because of its overhead light-rail tracks. Although alternative development uses are possible, it appears that the city of Lynnwood is encouraging development of the city center north of the transit center, rather than in this location, which faces inefficient road alignments for potential site tenants. The school district uses proposed for this area appear to be ideal neighbors for Sound Transit, and neighboring uses might be less costly than a complete relocation of the school district. Final decisions about the best use for the potential surplus property if the school district were to relocate altogether would require further information on the city's plans for the areas around the stations.

In addition to the school district's existing investment in the site, the proposed timing for development of the site might outpace Sound Transit's plans. Sound Transit's timing should present no conflict for the school district's construction of the bus and food distribution facilities. However, depending on the transit-oriented development site selected for the administrative offices, it is possible that the school district offices may need to remain in their current location longer than preferred or relocate temporarily to an intermediate location. In order to propose a solution that would be amenable to the school district, the existing location and condition of the school district administrative offices require further investigation.

The surrounding community appears to have pledged support for the school district's plans, despite associated traffic impacts and pollution emanating from the bus depot. One reason for community support is the perceived lack of visual impact presented by those plans. Sound Transit's current plans call for the removal of an existing row of large conifers along the primary frontage on 52nd Avenue. It is likely that Sound Transit could reduce community opposition by reconfiguring its plans to accommodate the preservation of existing trees and to add landscaping and an attractive service building along the rest of the 52nd Avenue frontage.

The extensive length of Sound Transit's proposed building along 52nd Avenue could be perceived as a positive design factor if the facility is constructed in a visually appealing way, similar to Sound Transit's existing maintenance facility. Landscaping and an attractive building would shield the residential community from the sight of both light-rail car and school bus storage. In addition, although the electric rail cars are generally quiet, the building and landscaping border along 52nd Avenue could help damp the sound of bus engines activated in the early morning hours when residents are home and exposed to the operational disturbance.



Modifying the site plan would bring together complementary uses and enhance transit-oriented development opportunities.

Alternative 2 is located in the city of Bellevue, along the south side of State Route 520 in the Bel-Red corridor.

Encroachment on existing wetlands presents another challenge to activation of the site for Sound Transit. The proposed design appears to include efforts to minimize wetlands encroachment, but it is clear that the track configuration requirements impose restrictions on eliminating impacts altogether. It appears that the community places a high value on the wetlands, so Sound Transit should pursue mitigation strategies elsewhere in the surrounding wetlands to reduce impacts, both as a requirement for environmental approvals and to build community support. It is likely that the Interurban Trail will see much more activity once the new light-rail station opens, and there are opportunities for targeted wetlands improvements and educational engagement along the trail through the wetlands to the station.

Identifying the preferred site configuration for shared use by the two entities requires more information from the school district on its plans and needs. However, it appears likely that this site and surrounding property opportunities present a strong solution for both Sound Transit and the school district. If funding partnerships and collaboration efforts are strong enough to develop a solution for both parties, there is potential to have the rail yard and its attractive building and landscaping serve as a visually appealing buffer between the residential community and the bus depot.

Meanwhile, the school district's priority needs could be located within walking distance of each other and the transit station, linked by an attractive pedestrian trail through the locally valued wetlands. Sound Transit would benefit from potentially lower acquisition costs than those in Bellevue, from a functional lot suited to its OMSF needs, and from an anchor tenant in the school administration to support its transit-oriented development efforts surrounding the new Lynnwood Station.

SR520

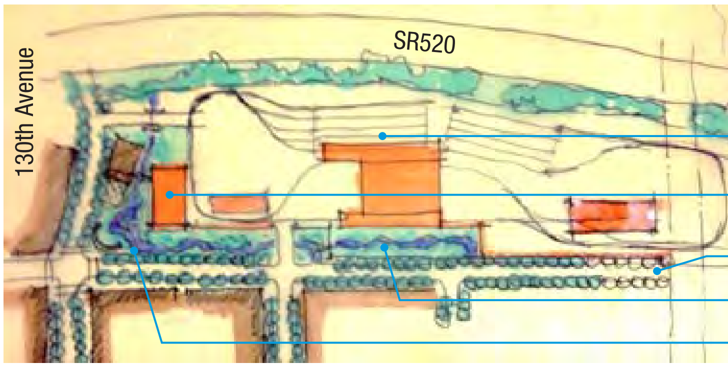
The SR520 alternative is inside the city of Bellevue, along the south side of State Route 520 in the Bel-Red corridor, the growing urban center between Bellevue and Redmond on the eastern side of the Seattle metropolitan area. This area has historically been dominated by small businesses and auto dealerships but, on the basis of land use projections, has the potential for increased demand for commercial development and housing in the city of Bellevue. Redmond is the terminus of the likely next phase of Sound Transit's Link light-rail expansion plans.

Bel-Red has been the focus of intensive planning for the last decade, based in part on the expected arrival of light-rail service, with three stations planned for the area. The intensive planning is also based on the projected high demand for commercial and residential space in Bellevue. The SR520 site is zoned for less intense development than other parts of Bel-Red, with 45-foot height limits, as compared with limits of up to 150 feet elsewhere. The SR520 site is close to the planned 130th Station but outside the quarter-mile radius around it.

The SR520 location poses two major challenges:

- *Intense existing use:* Because the designated footprint contains many existing businesses with complex tenant

A Proposal to "Slenderize" the SR 520 Site



relationships, acquiring the land needed to use this site as an OMSF would seem cost prohibitive.

- *Impractical to build over:* Cantilevering or building over a podium does not seem to be a viable option at this location. The sloping topography makes it less practical to build on, and transit-oriented development overhead would be inhibited by the 45-foot height limit and the lack of buildable air rights after a podium adequate to house any part of the OMSF program is built.

Even given these formidable challenges, it would be possible to build an OMSF that is compatible with the desired redevelopment of the Bel-Red corridor. Doing so could hinge on three interrelated strategies:

1. Move the OMSF footprint a step eastward. This achieves two important advantages over the current placement. It opens space on the west side that allows for a scenic and environmental amenity for the redeveloping community, and possibly a daylighted creek (Goff Creek) that meets the environmental goals of the city and the region. And it brings the facility closer to the Sound Transit light-rail right-of-way to the east. This right-of-way appears to include an aerial guideway that would be problematic for many kinds of development. The combination of the OMSF site alternative as currently laid out and the position of the guideway would also tend to isolate the parcel that now lies between these two. Moving the footprint to the east and acquiring the parcel next to the guideway may present opportunities for shared parking or other compatible uses there and make the OMSF a better net contributor to the economic development of Bel-Red.

Because of the positions of the two roadways on either side of the site (State Route 520 and Northeast 20th Street), accomplishing this shift would require a number of measures to compress the north–south width of the OMSF, especially at the eastern end. However, this appears to be feasible without sacrificing the functionality of the facility (see strategy 3).

2. Develop a public open space and green buffers. By creating a park-like open space along 130th Avenue Northeast on the west side of the OMSF, Sound Transit has the opportunity to give the redeveloping neighborhood a functional green buffer that could accommodate daylighted Goff Creek and accomplish an established environmental goal for Bel-Red and surrounding neighborhoods. Moving the OMSF program 250 feet to the east could accomplish this. It could join a green strip along Northeast 20th Street on the southern edge of the currently proposed OMSF. The contiguous landscape could be designed to feature a combination of trees, a naturalistic creek bed, rain gardens, paths, and educational signage. The intersection of 130th Avenue Northeast and Northeast 20th Street could become a gateway into the Bridle Trails neighborhood to the north. The green space could enrich the daily lives of new residents and provide an attractive amenity for the few Sound Transit personnel who occupy the OMSF site during daylight hours.

The BNSF site is located in the Bel-Red corridor along the east side of a BNSF right-of-way, now called the Eastside Rail Corridor.

3. Consolidate the program and move the operations building. There are two strategies for fitting the OMSF onto the narrower, eastward-shifted footprint. The first is to cantilever the administrative building, now shown near the center of the site, over the storage tracks. The other is to move the operations building around to the west, just inside the green space along 130th Avenue Northeast. Looking over open space on one side, the operations building could be a landmark, viewable from the 130th Station and other points in Bel-Red.

This alternative could ultimately be cost prohibitive because the site is fully developed and fully operational. Existing businesses would have to be relocated. Although retail structures across the street could house relocated retailers, the resulting one-sided retail would not be ideal and tenants might be apprehensive about the OMSF operations across the street.

BNSF Sites

The BNSF site and its alternatives lie within the Bel-Red corridor in a north–south orientation along the east side of a former BNSF railroad right-of-way, now called the Eastside Rail Corridor. The site is currently dominated by lower-intensity warehouse uses, but the south end is well within a quarter-mile radius of the planned 120th Station and near the center of an area designated for very dense transit-oriented development. A medical district lies to the west, on the other side of the 100-foot-wide rail corridor right-of-way.

Two alternatives for the use of the BNSF site have been studied by Sound Transit. BNSF Base is situated entirely to the east of the BNSF right-of-way and to the west of the current path of 120th Avenue Northeast. BNSF Modified shifts the footprint of the OMSF to the west, spanning the former BNSF right-of-way. The panel proposes a third alternative, BNSF Hybrid. It would make partial use of the former BNSF right-of-way and also alter the street grid slightly by straightening the path of 120th Avenue Northeast.

BNSF Base

The BNSF site presents a challenge, not because of current land uses on and around it, but because the city of Bellevue undertook a four-year process to replan and rezone the 912 acres in anticipation of the light-rail service. The plan focuses on two stations—120th Station and 130th Station—with a third, Hospital District Station, bordering the area to the south. Bel-Red is poised to transition from primarily industrial and auto-dependent uses to much more dense commercial, residential, and mixed-use development. The city of Bellevue has identified a demand by 2030 for over 4.5 million square feet of commercial space and 5,000 new housing units, and therefore has rezoned the entirety of what was once a largely light industrial warehouse district into what is expected to be a vibrant transit-oriented development district with floor/

BNSF Modified is a variation of the BNSF Base site that shifts the facility's footprint to the west.

area ratios up to 4.0 and height limits for commercial and residential uses of 150 feet.

The BNSF site, buffering the medical district with 100 feet of BNSF right-of-way on the west, a car dealership to the south, and a warehousing and bus storage facility to the north and east, would have been ideal before the approval of the Bel-Red plan in 2009. Now an OMSF use there is seen as incompatible with the current vision for the corridor and projects underway by the public and private sectors.

Each of the BNSF alternatives presents a special challenge owing to conflicting demand for dense, transit-oriented development on and near the site. For example, the south end of the rectangular OMSF site is located within the transit-oriented development node immediately adjacent to the 120th Station. This station is at the center of the Spring District master-planned development, an extremely dense, mixed-use, transit-oriented community and the focus of long-range planning within Bel-Red.

Advantages of the location include the fact that Sound Transit has already acquired a large portion of the necessary 25 acres, a 10.3-acre parcel formerly owned by International Paper. There is a car dealership to the south of the OMSF footprint and warehousing and a bus storage facility to the north and east of it.

BNSF Base accommodates all of the needs for the OMSF at a reasonable cost and incorporates land already acquired by Sound Transit for this use. The plan provides for 24 storage bays, accommodating 96 trains as well as the appropriate support facilities. The former BNSF right-of-way itself provides a valuable buffer for the site, while accommodating a future hike-and-bike trail. As currently configured, the OMSF is pushed northward toward the existing rail spur, which leaves the southern and southeastern edge, facing the Spring District, available for transit-oriented development.

Because of the height and density now allowed by the city of Bellevue, it seems financially as well as practically feasible to construct podium-based development over the southern third of the site, which would expand the possibilities for transit-oriented development and further accommodate the Bel-Red plan. This may be considered feasible because of the long-term buildout of transit-oriented planning in Bel-Red and the extensive infrastructure component of that buildout. Two special considerations could make podium development feasible and desirable for the BNSF site:

Site planning. The support buildings as well as the traction power substation should be placed to the north and parking moved to the south, essentially flipping the base plan along its north–south axis. Parking is an element of the program that would be conducive to placement under a podium.

Construction. Accommodations could be made to provide Sound Transit access to parts of the facility located within the podium structure during the over-podium construction, so as not to interfere with the daily operations of the OMSF.

BNSF Modified

This alternative would use the BNSF site but shift the OMSF footprint to the west, crossing the existing railroad right-of-way and freeing the east side of the BNSF site for transit-oriented development in the future.

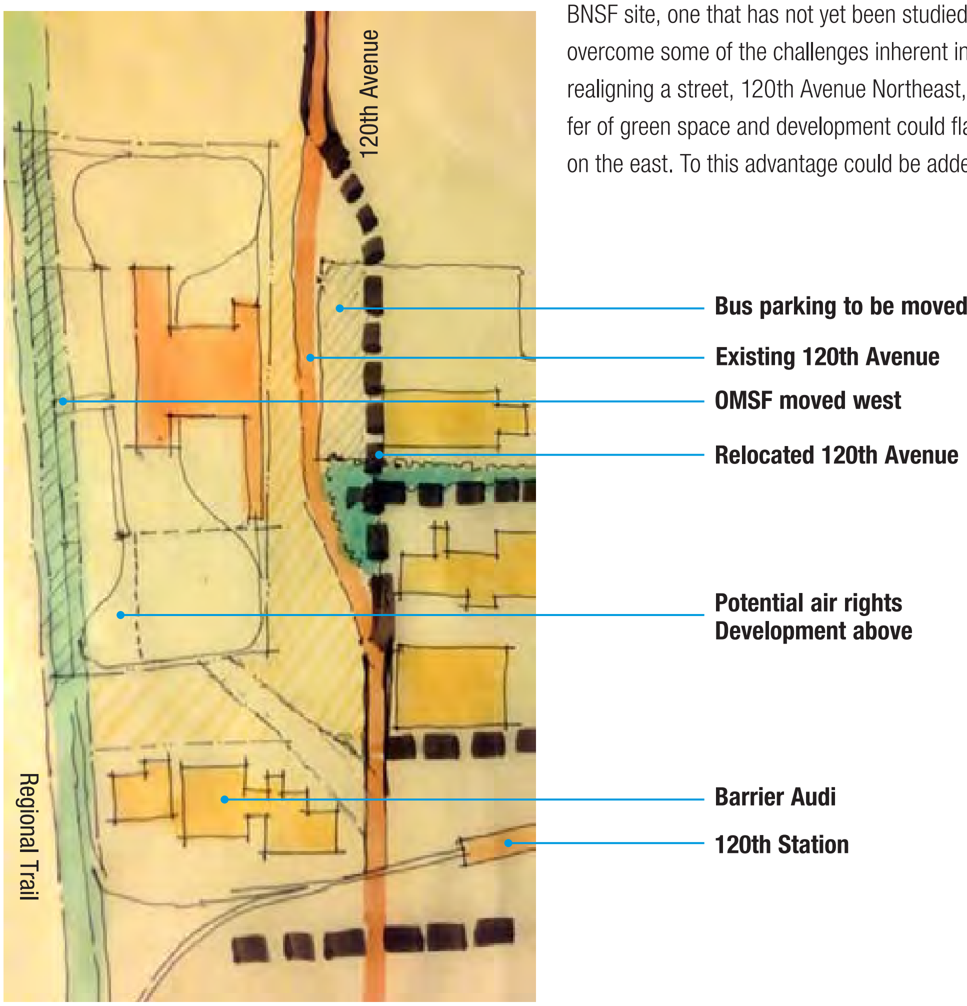
There are two major challenges associated with this alternative. The first is that it encroaches on a medical and office district to the east, requiring extensive takings including a regional public safety training facility. The second is that it would necessitate three aerial crossings of the BNSF right-of-way by light-rail tracks. In addition to bisecting the site, this could present potential security issues, as well as design issues related to the use of the right-of-way to extend light-rail service to nearby Kirkland.

Shifting the OMSF footprint to the west would free up land in a location that is very desirable for mixed-use, pedestrian-oriented development around the 120th Station that includes the Spring District master-planned development in Bel-Red. The BNSF Modified alternative would achieve three goals: leaving a strip of land available for development on the east side of the site, providing a green buffer between the facility and the street grid, and helping to support nearby development and the city's plan for greater density around transit.

BNSF Hybrid

The hybrid alternative is a second modification of the BNSF site, one that has not yet been studied. It would overcome some of the challenges inherent in the site by realigning a street, 120th Avenue Northeast, so that a buffer of green space and development could flank the OMSF on the east. To this advantage could be added the option

BNSF Hybrid Recommendations



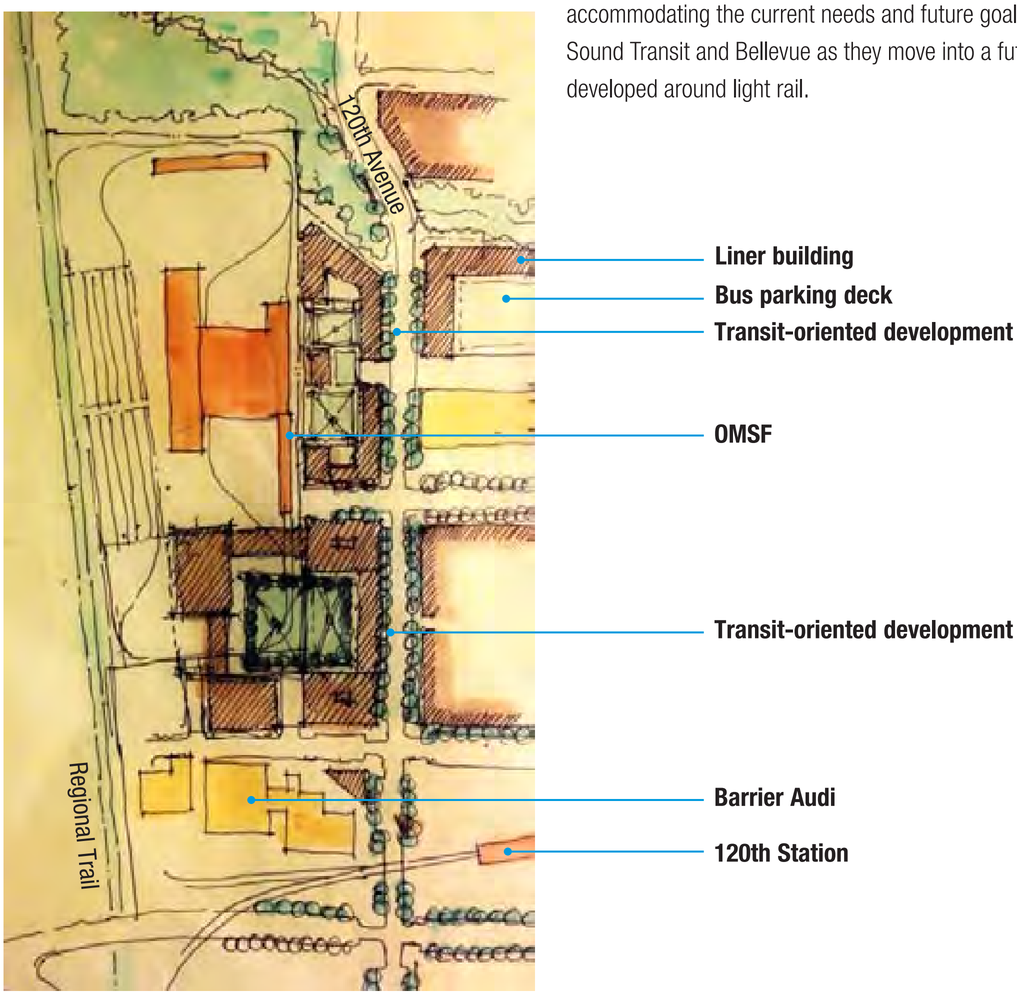
to build a podium on the southern third of the OMSF and allow for dense development in the air rights above it.

The BNSF Hybrid alternative would use a portion of the former BNSF right-of-way to accommodate 8 to 24 light-rail vehicle storage bays extending north. Compared with BNSF Modified, this alternative would consolidate the OMSF while pulling vehicular storage back to the east side of the right-of-way and away from the medical district, leaving enough right-of-way for the regional hike-and-bike trail and future extension of light rail to Kirkland along the right-of-way.

A key component of BNSF Hybrid is the proposed realignment of 120th Avenue Northeast toward the east. This would straighten the roadway's jagged north–south alignment, running it partially over a bus yard and opening up land for transit-oriented development. It would, however, significantly affect the number of buses that could park at the facility.

As noted above, the area surrounding the BNSF site still contains mostly light industrial and warehouse uses, including a large bus yard owned by King County. These uses will give way to transit-oriented development over time. As with the BNSF Base alternative, BNSF Hybrid would allow for decking over the southern third of the site. This hybrid could be accomplished over the long term and phased in as development opportunities occur, while accommodating the current needs and future goals of both Sound Transit and Bellevue as they move into a future developed around light rail.

BNSF Hybrid Buildout



Key Elements

AS DECISIONS ARE MADE about situating and designing OMSFs, careful consideration must be given to three key elements: design, facility size and capacity, and messaging and mitigation.

Design Considerations

Several thoughtful design strategies can be taken into account when integrating a light-rail operations and maintenance facility into existing land uses, to help improve community acceptance and address or mitigate perceived negative impacts of the facility, including noise, visual impact, light spillover, and aesthetics.

Examples of strategies that have been used in projects around the country involve various elements:

- *Site planning.* Overall orientation and layout can minimize impacts on the most sensitive surroundings. Setbacks from the edge of the site allow for community benefits in the form of development or open space.
- *Screening.* Larger buildings can be used to screen the train storage yard from surroundings.
- *Sound.* Special walls can damp sound in sensitive spots.
- *Materials.* With minimal expense, the selection of materials can make buildings more acceptable and more compatible with surroundings.
- *Architecture.* High-quality design can make a significant difference in community acceptance.
- *Landscaping.* Integration of green strips and trees and other plantings into the project can soften long facades and make an OMSF a better neighbor.
- *Tracks.* Careful planning can eliminate unnecessary train movements and associated noise. Larger-curve radii can mitigate the sound of wheels squealing.
- *Noise containment.* Enclosing vehicle washing and blowers, limiting the use of public address systems, lowering the decibel levels of train bells during sensitive time frames, and conducting limited or no exterior train maintenance can all be employed to reduce noise coming from the operations.
- *Sustainability.* Overall integration of efficiencies and environmentally responsible design is likely to enhance community acceptance and support.

Case Example: Exposition OMSF

An example of such a facility is the Exposition OMSF currently being constructed in Los Angeles, California, by the Exposition Construction Authority (Expo). The proposed facility started in a highly controversial manner, with little to no public support from community stakeholders or elected officials. Throughout the selection, design, and entitlement process, Expo staff and the design team held numerous community meetings and workshops in an effort to understand the concerns of the community so that the facility could be designed to mitigate perceived impacts while still achieving the operational goals of the facility.

As could be expected, the primary concerns from the community centered on impacts such as incompatibility with the adjacent residential and office land use, noise, light pollution, hazardous materials, air quality, and aesthetic issues. Furthermore, an undercurrent of environmental justice ran through the selection process, because the affected residential neighborhood is a lower-income one with little open space and a disproportionate share of city infrastructure.

The largest design consideration made by the design team occurred early on, when Expo and the city agreed to set aside an approximately three-acre linear strip that traversed the entire frontage of the facility so as to buffer the facility from the residential neighborhood. This buffer was envisioned as either development or open space, but eventually the community coalesced around the idea of a community park. Expo is setting aside the land, and the city and community continue to collaborate on the design of the community park.

Several other considerations were included within the design of the Expo facility to address perceived negative impacts:

- Lengthening and elongating the maintenance and administration building to mitigate noise impacts;
- Installing a 12-foot-high sound wall around the facility;
- Designing an aesthetically pleasing glass lobby, which acts as an introduction and a focal point;
- Landscaping to soften the edges of the sides and facade;
- Thoughtfully selecting materials and the design of the exterior walls and building;
- Relocating the traction power substation for least intrusion;
- Relocating the emergency generator and sound-attenuating enclosure;
- Using shrouded directional lighting as opposed to typical "stadium" lighting;
- Minimizing unnecessary train movements;
- Instituting policies such as prohibiting public address systems and requiring that shop doors be closed during work at night; and
- Incorporating sustainable features into the design, such as stormwater retention, energy efficiency, and drought-tolerant landscaping.

The Expo facility is just one example among many of how thoughtful design and community collaboration can enhance a facility and mitigate perceived environmental impacts. The key is to work collaboratively with community stakeholders, listen, and actually incorporate the design solutions into the project.

Case Example: SoDo OMSF

The SoDo OMSF in Seattle is another good example of integration with the surrounding land use. Although the neighborhood is more industrial, the architecture is very attractive, public art was integrated into the facility, there do not appear to be negative impacts, and no complaints have been received from the surrounding uses (including residential lofts). It is apparent that Sound Transit has integrated much of this thinking and these design solutions into the proposed OMSF sites in Bellevue and Lynnwood.

Facility Size and Capacity Considerations

Facility size and capacity determine both the ease with which a facility can be integrated within an existing context and its impacts on economic development. There are certain operational needs and requirements for the OMSF, but even within those parameters the width of the facility's physical footprint can sometimes be reduced. This can yield excess land in the form of frontage that can be used to address community goals such as economic development, landscaping and screening, open space, and other public benefits. Although it is clear that in order to operate efficiently some operational needs and requirements cannot be sacrificed, some potentially deployable strategies could reduce footprints.

Reduce Fleet Size

If it is possible to revisit fleet size and storage capacity, doing so could yield important options for better compatibility with the community. All of the proposed OMSF sites appear to be designed for a fleet of 96 vehicles. If operational constraints allowed for a reduced fleet of 82 vehicles, two storage tracks and one service and inspection bay could be removed from the site plan. If this reduction worked with the track geometry and switching, it could produce perhaps 60 feet of frontage land that could be used for some type of development, screening, or public use.

Cantilever Building Construction

Another approach is to look for a way to move or reorient the primary maintenance facility farther away from the street frontage by cantilevering building footprints over the storage tracks. An example of this approach is the Expo facility in Santa Monica, where the administration building and yard tower are cantilevered over storage and runaround tracks. Although this may add expense, it is potentially feasible and may help to address community concerns and meet development goals.

Messaging and Mitigation Considerations

The larger Puget Sound area has embraced light-rail service and expansion. However, the prospect of OMSFs for trains is already meeting resistance within specific communities where they might be situated. Concerns voiced include perceived environmental issues such as pollutants, noise, light spillover, and aesthetic impacts. The following specific concerns are typical:

- *Pollutants.* There are no air quality impacts or hazardous material concerns for any of the proposed OMSF sites. The train sets are electric and produce no emissions. The only known sources of emissions on the proposed sites would be the 30 non-revenue vehicles expected there and an emergency generator that would be used only occasionally. Sound Transit has also committed not to operate a paint and body shop at the proposed site, which eliminates the need for usage of hazardous materials with the exception of small quantities of gear oil and cleaners.
- *Noise.* Unlike traditional train yards, very few noise sources are involved in the operation of the OMSF sites. But anticipating the minor sources that do exist and mitigating or eliminating them could preclude clashes with the community, either before or after construction. Possible sources include train bells (required before moving a train), public address systems, train washing and blowers, potential wheel squealing at tight turns, ventilation of the traction power substation, and coupling of trains. Maintenance of the vehicles will be performed within the building, and all of the site plans contain washing and blow-drying activities within a building. Through design considerations such as building length and sound and security walls, the perceived noise issues of train bells and wheel squeal can be addressed. Public address systems can be replaced with mobile communication devices. The panel also understands that Sound Transit environmental staff have performed noise studies and sound analyses which confirm no or minimal impact.
- *Light.* Light spillover and aesthetic concerns can be addressed easily through thoughtful design and architecture that accomplishes the facility goals but is also sensitive to each community.
- *Aesthetic impacts.* There are numerous examples across the country of light-rail operations and maintenance facilities that have been designed under public scrutiny and defy the expectations of a typical rail yard. A few of them are the Elati OMSF in Denver, Colorado; the Sky Harbor OMSF in Phoenix, Arizona; the Expo OMSF in Santa Monica, California; and, most important, the SoDo OMSF in Seattle. All of these facilities went through public vetting processes and were designed and constructed to be compatible with the surrounding land uses, and none have impacted surrounding communities negatively. Sound Transit staff could use these examples and others in a messaging campaign to dispel the negative connotation of “train yard” and garner community support for the proposed sites.

Sound Transit staff should make a priority of refining and improving messaging regarding the OMSF, in an attempt to preempt and mitigate community concerns that an OMSF is an incompatible land use—a noisy, polluting “train yard”—in their neighborhood. Although it may never be possible to gain complete community support, the concept of a “softer” light industrial facility—one that could add to the community aesthetic rather than detract from it—should be communicated to the community stakeholders for each site.

Conclusion

THE PUGET SOUND AREA is a sophisticated region, already setting national and global models for development. Transit, and especially Sound Transit's Link light-rail service, is a key driver of the development of the city and the region. The existing O&M facility, along with two additional O&M facilities planned, will support the system far into the future.

Panel touring BNSF site.

Locating an OMSF is difficult, but Sound Transit has already made important progress in analyzing and assessing sites. Some resistance from cities and neighborhoods can be anticipated. But there are many strategies for making this non-polluting and fairly quiet facility a better neighbor, with gains for adjacent properties and neighborhoods. The benefits of making the OMSF more compatible will pay off in the long run, through healthier communities, more transit-oriented development, better ridership, and more willingness to negotiate with the agency on future land use questions. By choosing locations well and providing meaningful contributions to the economic health and livability of the surrounding areas, Sound Transit can help to ensure that OMSF placement and development is an acceptable and even welcome part of the growing Link light-rail system, and to accelerate regional progress toward a more connected, more vital, and much more sustainable future.

About the Panel

Marilee Utter

Chair
Denver, Colorado

Utter is executive vice president, district councils, at the Urban Land Institute. She oversees the staff and management of ULI's 70-plus national and district councils around the world, and holds executive team responsibility for global strategy, investment, and management.

Previously, Utter was founder and president of Citiventure Associates LLC, and managing partner of P3 West LLC. Both firms worked nationally and focused on public-private transactions, infrastructure, and development of mixed-use projects, transit-oriented developments, failed mall sites, and large-scale master plans.

In addition to her experience as a banker with what is now Wells Fargo Bank and as a private developer (with Trillium Corporation, managing the revitalization of Denver's Central Platte Valley rail yards), she established the Office of Asset Management for the city and county of Denver, and the Department of Transit-Oriented Development for the Denver Regional Transit District.

With this unique background, Utter has become a nationally known speaker, writer, and advisor on innovative approaches to community redevelopment and urban issues. She holds a masters in business administration from UCLA's Anderson School, a certificate in state and local public policy from Harvard's Kennedy School, and a designation from the Counselors of Real Estate (CRE). She is a past national trustee for the Urban Land Institute and chair of ULI Colorado. In addition, she serves on the boards of many community organizations, including the Metropolitan State College of Denver Foundation and the Center for Visual Arts.

Hannah Henn

New York, New York

Henn is assistant vice president and director of ferries in the New York City Economic Development Corporation's Ports and Transportation group. Her responsibilities include planning, procurement, management, and oversight of city-sponsored ferry services. Recent policy publications and initiatives include a citywide ferry study, which was released as a preliminary report in December 2013, and *Ferry Policy and Planning in New York City*, a discussion of ferry lessons learned and service considerations in the New York harbor. Henn also has a strong interest in providing equity and job accessibility through transit. She is currently contributing to a citywide transit access study for the city of New York.

Previously, Henn performed structural bridge design work in Philadelphia and acted as a construction manager for large-scale adaptive use urban projects in Providence, Rhode Island. She continued her engineering and construction work for the Metropolitan Transportation Authority's Bridges and Tunnels group in New York City before returning to graduate school to pursue her interest in policy. She holds a bachelor's degree in structural civil engineering from Brown University and a master's of public administration in urban policy from Columbia University.

Tim Lindholm

Los Angeles, California

Lindholm is deputy executive officer for project management for Los Angeles Metro. He has been with the agency since 1999. He is responsible for all engineering and construction projects related to Metro bus and rail facilities, including passenger terminals, stations, and 15 operations and maintenance facilities located throughout Los Angeles County. Lindholm recently completed construction on Metro's fifth LEED Gold building, the $60 million El Monte Bus Station, which this year received an Award of Merit in transportation from *Engineering News Record*.

Currently Lindholm is managing construction of Metro's Division 13 bus operations and maintenance facility in downtown Los Angeles, a new light-rail operations and maintenance facility for the Expo Line in Santa Monica, and a new bus station within the Union Station complex in downtown Los Angeles. He is a graduate of San Diego State University and a State of California Professional Geologist.

Neal Payton

Los Angeles, California

Payton is principal at Torti Gallas and Partners Inc., where he created and directs the West Coast office in Los Angeles. Before arriving in California, he codirected the firm's urban design efforts in its Washington, D.C., area office. Often called upon to work on politically sensitive sites, including multi-ethnic or racially diverse neighborhoods, he has led more than 80 community design charrettes.

Payton's urban design efforts have been honored nationally with two American Institute of Architects (AIA) Honor Awards for Regional and Urban Design, an AIA Housing Committee Award, and four Charter Awards from the Congress for the New Urbanism. Included in these award-winning efforts are a set of transit-oriented developments along Washington, D.C.'s Metro rail lines. His master plan for Coast Highway (Historic Route 101) in Oceanside, California, received an Honor Award for Outstanding Neighborhood Planning from the California chapter of the American Planning Association in 2010. The planning of the New Wyvernwood, in the Boyle Heights neighborhood of Los Angeles, which he led, was recently awarded a Congress of the New Urbanism Charter Award. His current work includes a new Downtown-Specific Plan in Santa Monica, at the terminus of the new Expo Light Rail line, and a plan for Downtown Westminster, Colorado, on the site of a former shopping mall.

Payton is a frequent speaker at the Congress for the New Urbanism, the AIA, the Urban Land Institute, the National Association of Home Builders, and the American Planning Association, as well as a periodic guest lecturer at a number of universities. He was also a Knight Fellow in Community Building at the University of Miami, Florida.

Jack Wierzenski

Dallas, Texas

Wierzenski is director of economic development for Dallas Area Rapid Transit (DART), which he joined in 1991. He is responsible for developing and implementing strategies to capture transit-oriented-development opportunities and benefits around DART's transit system. He serves as DART's primary point of contact with the development community and the 13 cities within its 700-square-mile service area to facilitate and implement transit-supportive development initiatives.

Before joining DART, Wierzenski was chief of transportation planning in Prince William County, Virginia, at the Virginia Department of Transportation, and worked for the cities of Austin and Galveston, Texas.

Wierzenski has served on the National Railvolution Conference Steering Committee since 1997 and is a member of the Urban Land Institute. He has participated on several ULI Advisory Services panels and is currently cochair of the ULI North Texas TOD Product Council.

Wierzenski received his master's degree in urban and regional planning from Texas A&M University in 1983 and a bachelor of arts degree in geography and political science from the University of Minnesota in 1981.

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